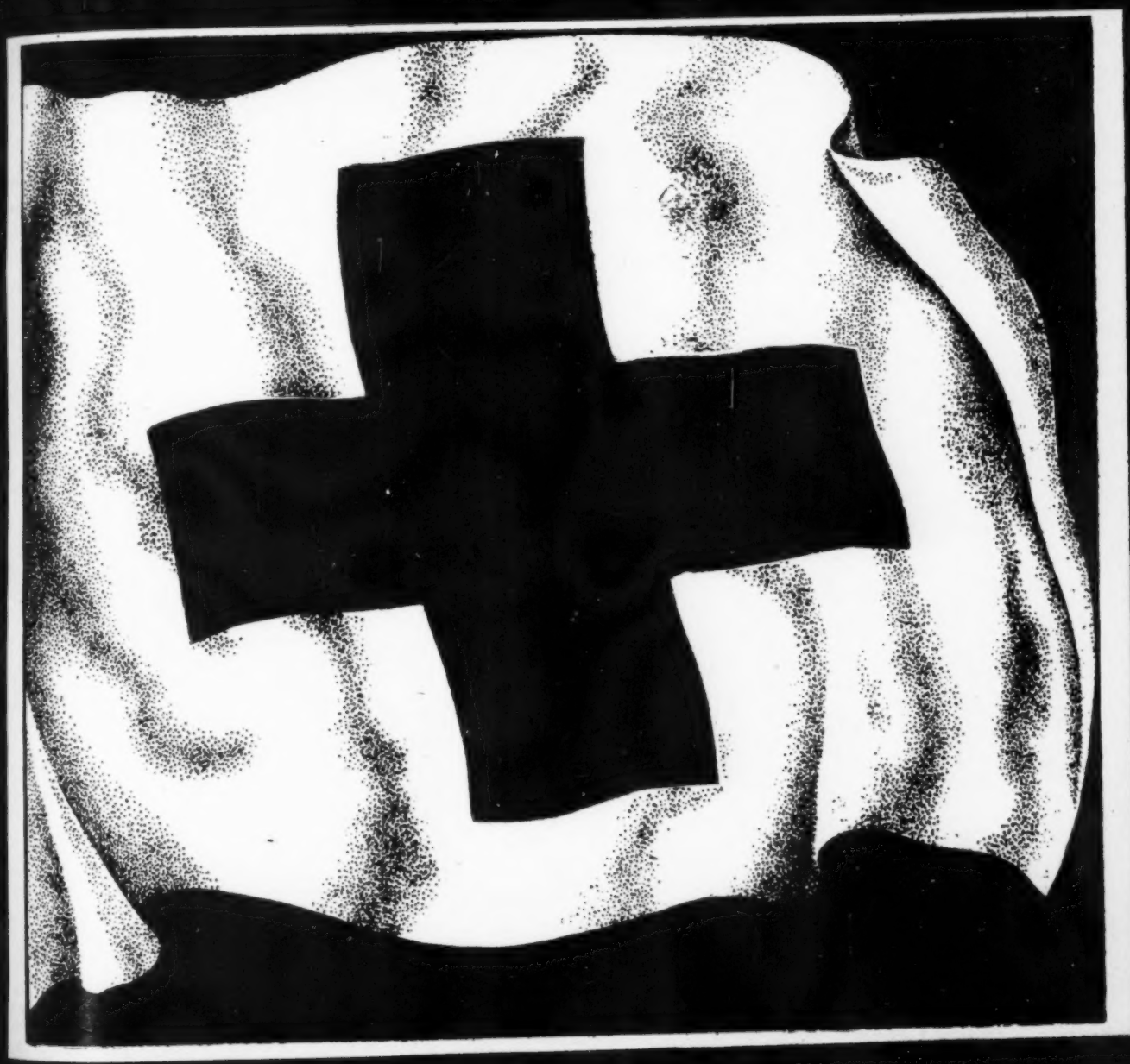
WATER WORKS & SEWERAGE



PENN SALT

LIQUID CHLORINE

A 31-Year Record
of service in the water treatment and sewage disposal fields
WRITE FOR FULL INFORMATION ON PENN SALT LIQUID CHLORINE

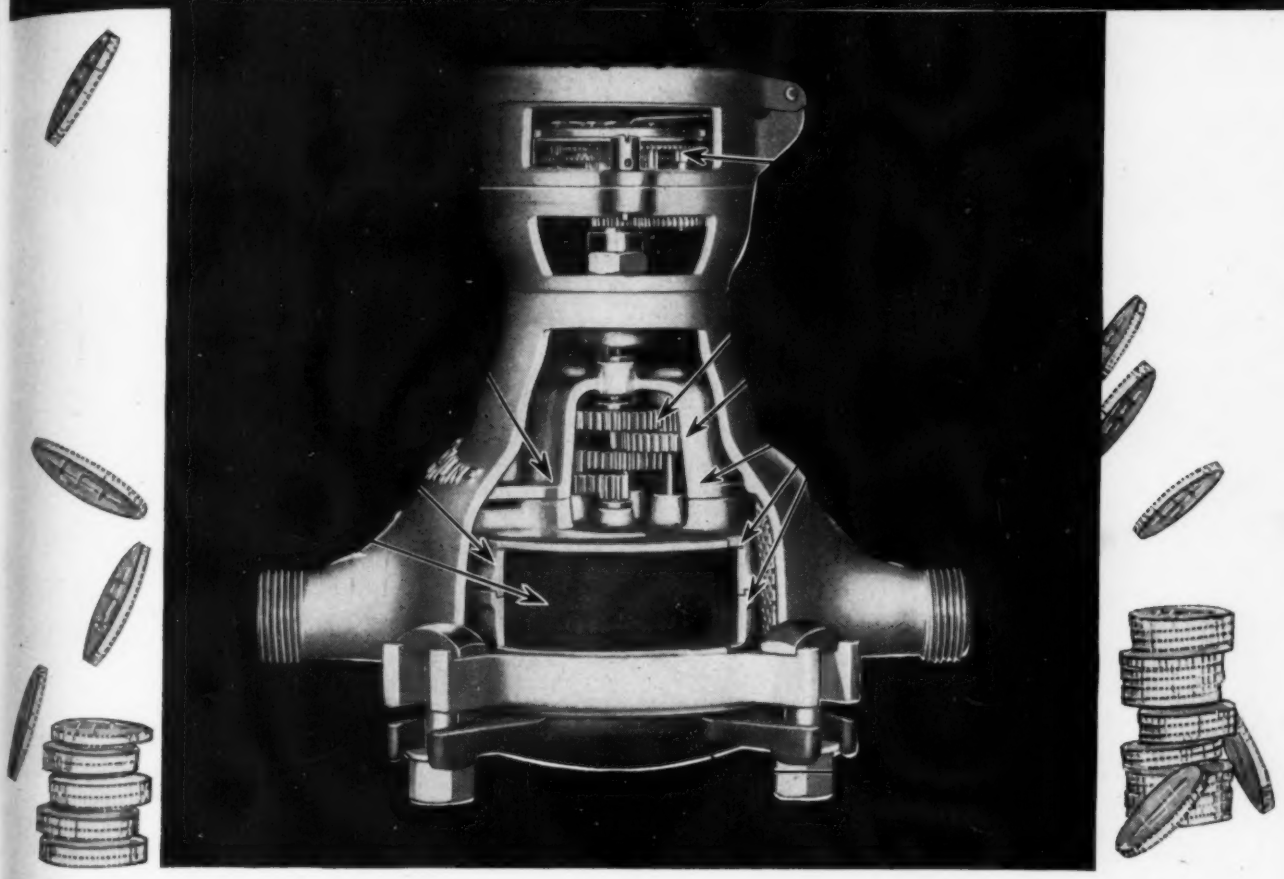
OTHER PENN SALT PRODUCTS INCLUDE

Anhydrous Ammonia
Filter Alum · Ferric Chloride
Sodium Aluminate
Chloride of Lime
Caustic Soda

PENNSYLVANIA SALT
MANUFACTURING COMPANY
Chemicals
1000 WIDENER BUILDING, PHILADELPHIA 7, PA.
NEW YORK · CHICAGO · ST. LOUIS · PITTSBURGH · CINCINNATI · MINNEAPOLIS · WYANDOTTE · TACOMA

WATER WORKS & SEWERAGE, March, 1945, Volume 92, Number 3. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under act of March 3, 1879.

A SOUND INVESTMENT IN DOMESTIC MEASUREMENT



Empire BALANCED OSCILLATING PISTON METERS

Meters represent a considerable investment, not only in money but in the time and labor it takes to install and service them. The wise buyer, when purchasing meters, compares both the initial cost as well as the construction features that will contribute to a trouble-free long life of sustained accuracy. He also looks into maintenance expense and, in particular, the ease with which meters can be serviced.

On every score EMPIRE meters stand out as a sound measurement investment. The time-proven EMPIRE balanced oscillating piston provides sustained maximum accuracy with minimum wear. The long service life of all EMPIRE meters can be supported by records extending over a 54 year span.

The utmost accessibility and maintenance ease have been provided in the EMPIRE "Streeemline" type. A snap-joint measuring chamber; only three interior castings that are assembled without screws, plus a design that permits complete assembly of all working parts before they are installed in the meter case contribute to meter shop efficiency and economy. Investigate the EMPIRE "Streeemline" when in the market for meters. You'll find that it sets the value standard against which all others must be judged.

PITTSBURGH EQUITABLE METER CO.

Atlanta Chicago Kansas City — **MERCO NORDSTROM VALVE CO.** Main Offices, PITTSBURGH, PA. — Los Angeles San Francisco Seattle New York Boston Houston Pittsburgh Tulsa

National Meter Division, Brooklyn, N. Y.

Water Meters

If your present or postwar plans call for large diameter pipe and special fittings why not avail yourself of the advisory service of our technical staff? Out of our long experience we are frequently able to suggest adaptations of design principles which have proved efficient and economical in other installations. Our facilities are extensive and include a specialized plant for the production of fittings.

Drawn for U. S. Pipe & Foundry Co. by Peter Helck

An Outpost!

AQUA NUCHAR DELIVERS PALATABLE WATER

A Lister Bag hardly looks like an implement of war, but actually it's a very important one. Lister Bags mean safe, palatable water for our fighting men . . . water that is clear and free of objectionable tastes and odors because it has been purified and treated with Aqua Nuchar Activated Carbon.

Aqua Nuchar makes water tasteless and odorless because it removes by adsorption those elements which cause unpalatability.

Aqua Nuchar is as valuable to the home front as it is to the war fronts. For that reason, more than 1200 communities have used Aqua Nuchar to bring palatable water to their taxpayers at the astoundingly low cost of less than two cents per capita per year.

Aqua Nuchar is stocked at convenient points throughout the United States—ready to serve you on a moment's notice.

Check your Aqua Nuchar stocks today. Be prepared for any change that may arise in your raw water supply!

BLUEPRINT NOW!

But above all, remember there is a war yet to be won. Maintain equipment to assure operation at 100% efficiency.

NUCHAR

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP & PAPER COMPANY

230 PARK AVENUE, NEW YORK 17, N.Y. · 35 E. WACKER DRIVE, CHICAGO 1, ILLINOIS · 748 PUBLIC LEDGER BLDG., PHILADELPHIA 6, PA. · 844 LEADER BLDG., CLEVELAND 14, OHIO

NEVER TIGHT AROUND THE COLLAR

When a deep frost closes in with a vise-like grip, Mathews Hydrants can take it. A loose protection-collar that fits around the hydrant, and extends below frost-level, relieves the hydrant of strain. All water-carrying parts, including the elbow, are safe.

For over 65 years, Mathews Hydrants have been built to meet emergencies in spite of cold, heat, accidents, and short-handed repair-crews. Specify Mathews Hydrants for your community and be sure of dependable protection with important maintenance-economies.

MATHEWS HYDRANTS

Made by **R. D. WOOD** *Company*

400 CHESTNUT STREET, PHILADELPHIA 5, PA.

MANUFACTURERS OF SAND SPUN PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND R. D. WOOD GATE VALVES

Wartime transportation peaks have created many problems for manufacturers dependent on the steady flow of chemicals to their plants. Columbia's efficient Traffic Service has done much to minimize these problems for its customers, and to ease their traffic supervision tasks. That's why many a Traffic Manager is in full accord with his company's policy of favoring Columbia as its source of chemical supplies.

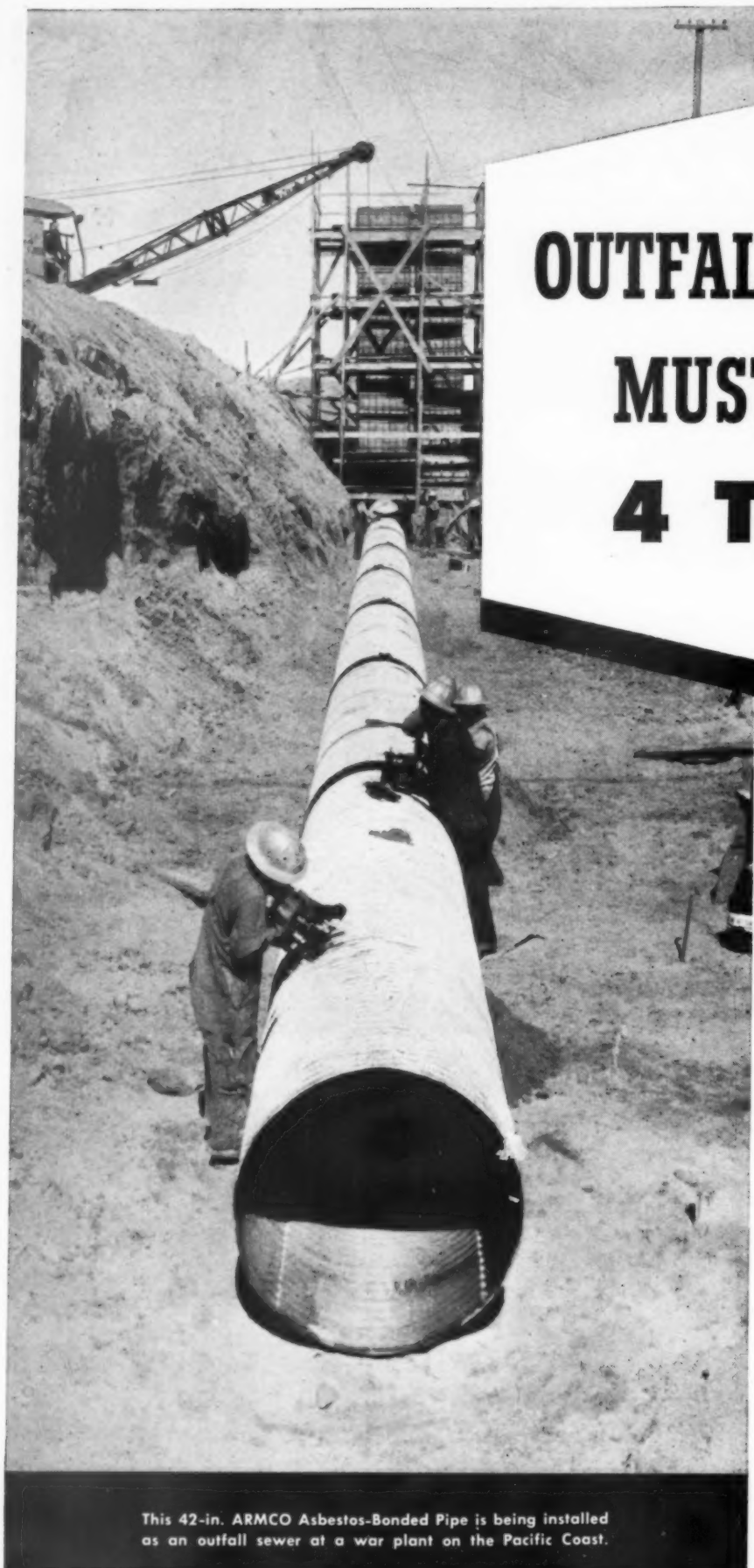
By their efficient handling of an unprecedented volume of traffic, the freight carriers have earned the thanks of the entire nation. They stress, however, the importance of the co-operation they have received from their customers. The job has indeed been so vast and so outstandingly successful that all Traffic men—both those employed by carriers and by their customers—can take pride in their contribution to America's war effort.

COLUMBIA CHEMICALS

PITTSBURGH PLATE GLASS COMPANY • COLUMBIA CHEMICAL DIVISION

GRANT BUILDING, PITTSBURGH 19, PENNSYLVANIA

Chicago • Boston • St. Louis • Pittsburgh • New York • Cincinnati • Cleveland • Philadelphia • Minneapolis • Charlotte • Los Angeles



OUTFALL SEWERS MUST MEET 4 TESTS

This 42-in. ARMCO Asbestos-Bonded Pipe is being installed as an outfall sewer at a war plant on the Pacific Coast.

That outfall sewer your plant or your community will need after the war should be designed against (1) disjointing and infiltration, (2) continual maintenance and early replacement, (3) severe service conditions, and (4) obsolescence.

You get these assurances when you specify ARMCO Asbestos-Bonded Paved Invert Pipe. (1) Long, lightweight sections are securely coupled together. (2) Flexibility protects against vibration and impact. (3) An asbestos-bonded coating over galvanizing, and a thick pavement in the bottom, assure long life under even the severest conditions. (4) This pipe is removable — has salvage value.

Write for the ARMCO Sewer Book. Address Armco Drainage Products Association, 405 Curtis Street, Middletown, Ohio.

ARMCO

ARMCO ASBESTOS-BONDED SEWER PIPE

Tomorrow's city . . .

. . . will have more FIRE PROTECTION . . . BEAUTY . . . ECONOMY through the use of

Waterspheres

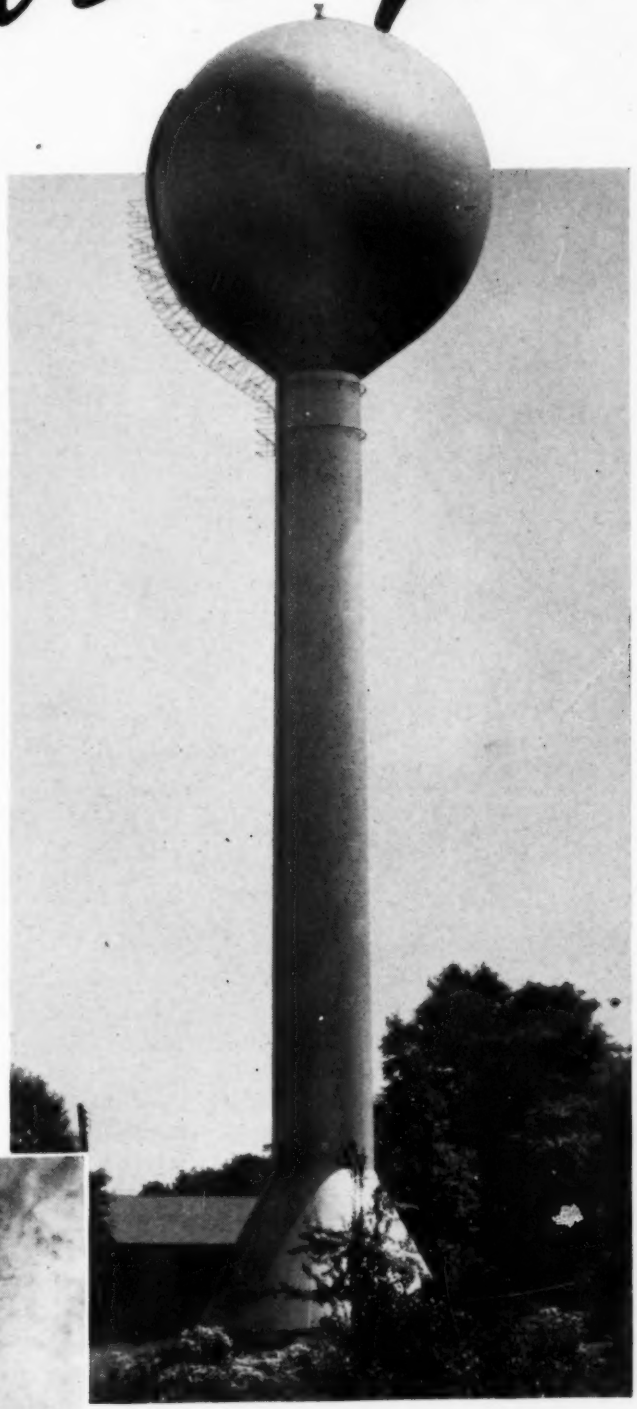
• Engineers who plan today for tomorrow's municipal water systems are giving more consideration to Waterspheres . . . for these elevated spherical storage tanks combine lasting stability with picturesque enhancement. In keeping with the architecture and needs of the future, Waterspheres offer municipalities the answer to "post-dated" water storage facilities.

The Watersphere has single cylindrical column construction that provides economical means of support. The spherical shape . . . requiring less material . . . and the smooth surface . . . results in a lower maintenance and neat appearance. These are just some of the features which invite public compliments for the engineer who chooses Watersphere . . . the efficient, long-life water storage tank of today and tomorrow.

★ ★ ★

The 100,000-gal. Watersphere shown at right is Madison, Wisconsin's solution to wide water pressure variation in one locality. Comparison of pressure charts show that where pressure varied more than 75 lbs. before the Watersphere was installed, this variation was reduced to a minimum when the new tank was placed in service.

If your file does not contain the fact-crammed report of how Tampa, Florida, cured its water distribution difficulties, write us today. Your copy will be sent by return mail.



The city of Kent, Ohio, installed the 250,000-gal. Watersphere shown above to provide greater fire protection and reduce pressure variations in its water work system.

CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Los Angeles 14.....1455 Wm. Fox Bldg.
Birmingham 1.....1586 North 50th Street

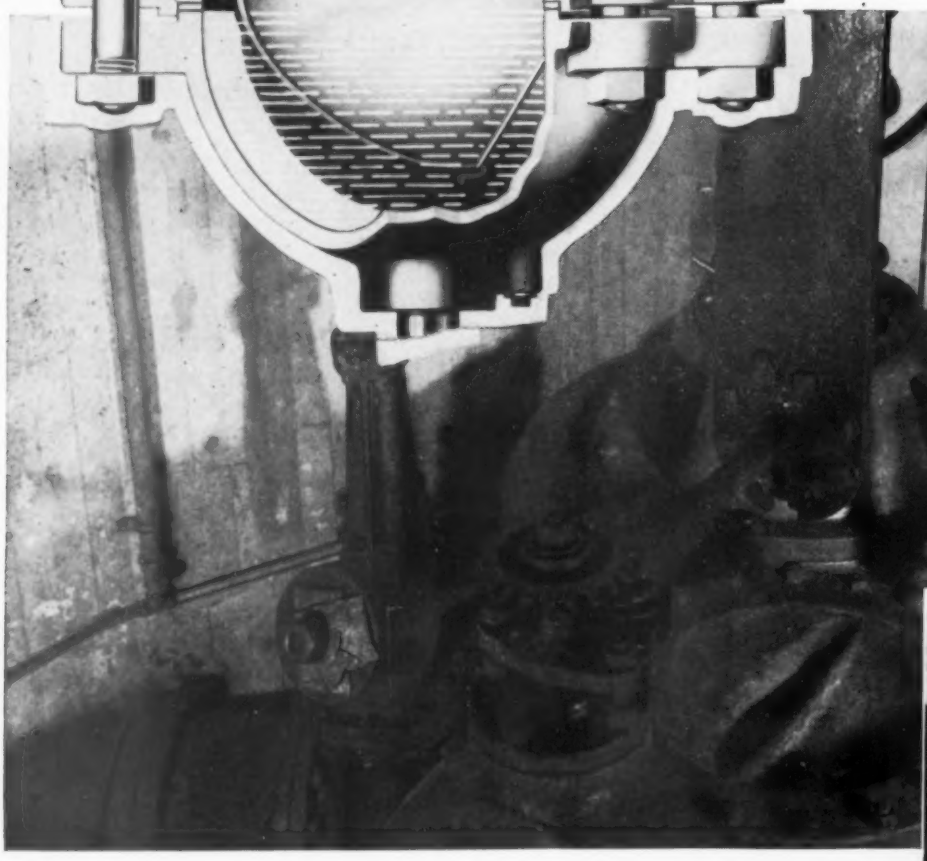
Plants in Birmingham, Chicago and Greenville, Pa.

Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Drive
Philadelphia 3.....1644-1700 Walnut Street Bldg.
Washington 4.....703 Atlantic Bldg.
San Francisco 5.....1083 Rialto Bldg.

In Canada: Horton Steel Works, Limited, Fort Erie, Ont.

The SIMPLEX AIR RELEASE VALVE

ELIMINATES SEWAGE PUMP SHUTDOWNS and MAINTAINS PEAK EFFICIENCY



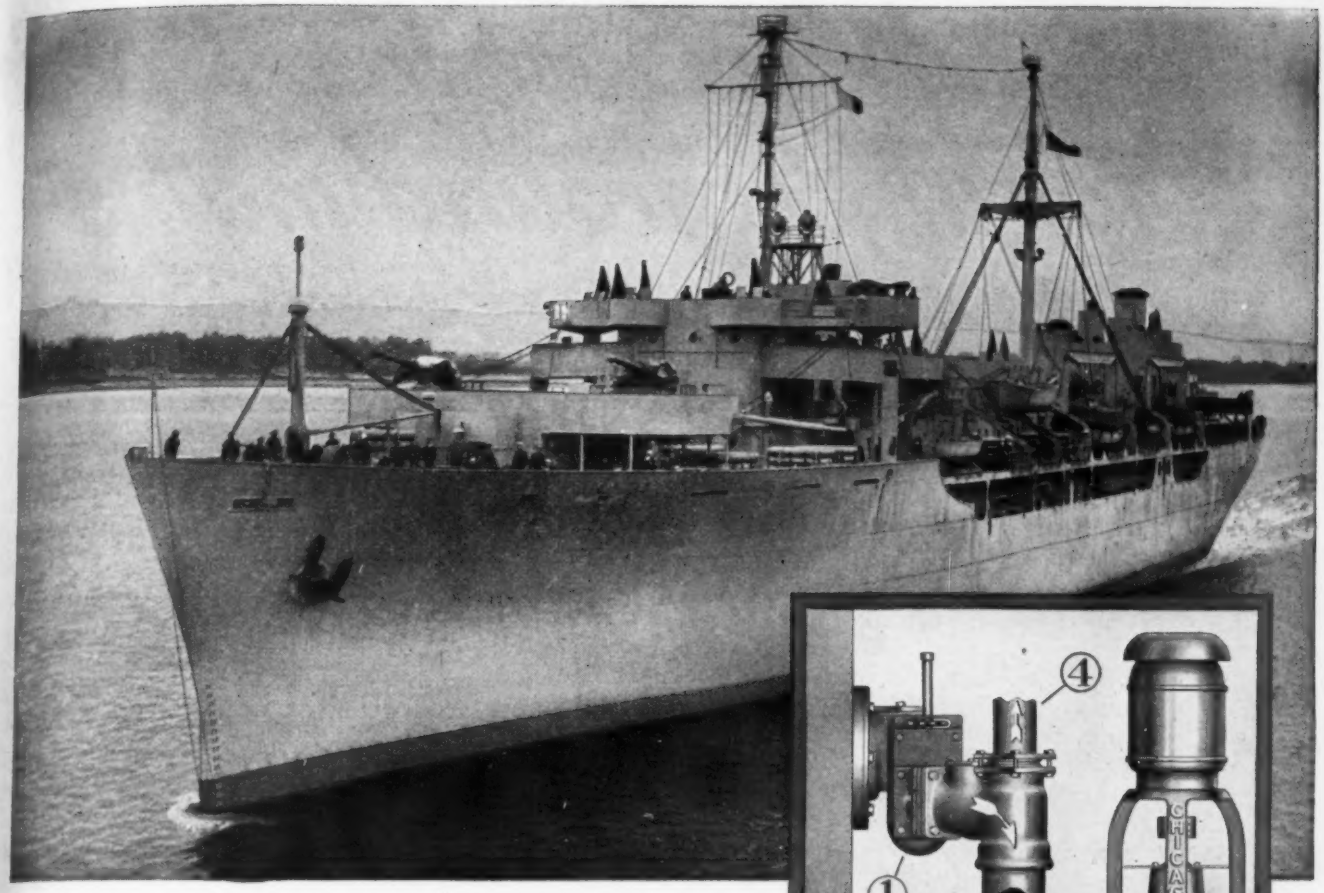
FORMERLY, complete shutdown at least once a day — now, easy routine flushing* once a week! Simplex Air Release Valves at the Pottstown Sewage Works maintain peak operating efficiency of sewage lines and pumps — eliminate frequent and costly shutdowns caused by trapped air and gases from decomposing organic matter.

Simplex Type "B" Valves are especially designed to meet the particular conditions of sewage service. Construction is simple and dependable. There is but one lever movement which operates a needle valve so designed as to be always tight-seating. The valve is operated by a heavy thickness glass ball float, tested to several times the service working pressure. A cast iron shell houses the actuating parts which are of corrosion-resisting materials.

Simplex engineers will gladly assist in the solution of your sewage flow problems. Write today for details.

**Routine weekly back-flushing at Pottstown Sewage Disposal Works, Pottstown, Pa., accomplished merely by opening the valve below hose connection shown to allow clear water to fill the release valve and the system. Flush is quickly and easily completed without dismantling any part of the installation.*

SIMPLEX VALVE & METER CO.
6743 UPLAND STREET, PHILADELPHIA 42, PENNA.



"Flush-Kleens" on U. S. Troop Transport (C-4 Type Vessel)

OVER 1,000 "FLUSH-KLEENS"

SELECTED FOR CLOG-PROOF SEWAGE PUMPING

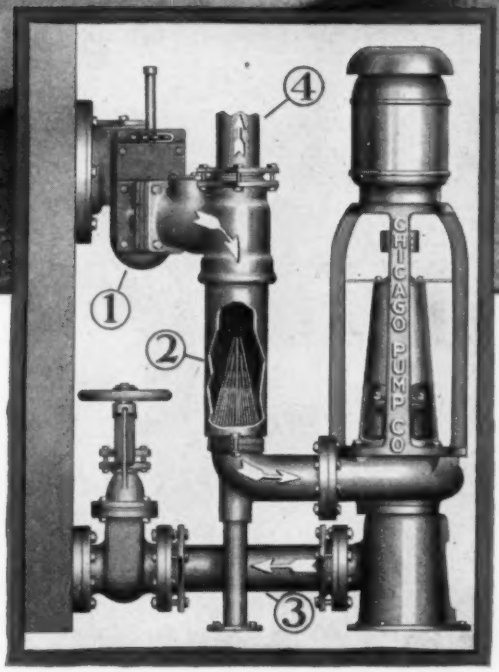
ON TROOP TRANSPORTS, AIRCRAFT CARRIERS, HOSPITAL SHIPS AND CARGO VESSELS

Recognition of "Flush-Kleens" by the Navy, Army Transportation Corps and the Maritime Commission was based on their unparalleled clog-proof sewage pumping service on the United States Liner S.S. America in 1939.

Over 3,000 "Flush-Kleens" have been installed in buildings, industrial plants, institutions and municipalities during the last twenty years.

Advantages over ordinary sewage pumps are: Cannot clog, more sanitary, no odors, less maintenance, greater efficiency and longer life, because solids do not pass through pump impellers.

Write for engineering data, application information and specifications.



"FLUSH-KLEENS" OPERATE ALTERNATELY

Sewage flows into basin through idle pump

FILLING WET WELL

① Sewage flows through inlet pipe.
② Coarse sewage matter is retained by strainer.
③ Strained sewage flows through idle pump to basin.

PUMPING

③ Strained sewage is pumped from basin.
② Coarse sewage matter is backwashed from strainer.
④ Special check valve closes; sewage and coarse matter are pumped to sewers.

Both pumps operate under peak flows.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2349 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

Why Cast Iron Pipe is the for underground mains

For twenty centuries engineers have experimented with many pipe materials for underground mains. About three centuries ago a new material—cast iron—first came into use. From then until now, the performance of cast iron pipe all over the world has made it the recognized *standard* by which other materials might well be measured, when under consideration for permanent construction.

This is so because of the proved long life and proved low cost of maintenance of cast iron pipe. Evidence of long life is supplied by cast iron lines still functioning in Europe after more than 200 years of service, and in England and America after more than 100 years of continuous satisfactory performance. Evidence of lowest cost of maintenance is found in comparative cost records supplied by Water Works Superintendents of 195 cities. For such reasons, more than 95 per cent of the pipe in the water distribution systems of America is cast iron pipe. Some, or all, of the *original* cast iron water mains are still in service in 200 out of 212 of America's largest cities.

Such evidence breeds trust and confidence. For example, where buried pipe is hard to get at for repairs or replacements, as in sewage treatment plants, more than 95% of all pipe installed is cast iron pipe. Long life saves the taxpayer money. In a depreciation study, by a Government department, of hundreds of materials and products, cast iron pipe is given the lowest rate of depreciation.

So we say, "Trust the pipe you know about." When you are tempted to experiment, remember that cast iron pipe is the recognized standard material for well-founded reasons — reasons which are disregarded only at the risk of ultimate higher cost to taxpayers.

Address inquiries to Cast Iron Pipe Research Association. Thomas F. Wolfe, Research Engineer, Peoples Gas Building, Chicago 3, Ill.

THE 10 REQUIREMENTS FOR UNDERGROUND MAINS

LONG LIFE: In evaluating bids, the useful life of cast iron pipe is 100 years minimum.

FLOW CAPACITY: Under normal conditions, the flow capacity of cast iron pipe remains practically unimpaired for centuries. For certain areas where active water is encountered, cement-lined cast iron pipe is available. Under such conditions, no other material offers the combined long life and sustained flow capacity of lined cast iron pipe.

TIGHT JOINTS: For ordinary pressures, cast iron bell-and-spigot pipe—for high pressures, cast iron mechanical joint pipe—are known to be leak-proof.

TENSILE STRENGTH: Standard cast iron pipe ranges from 23,000 to 30,000 pounds per square inch.

BEAM STRENGTH: Standard six-inch cast iron pipe bears up under a load of 17,500 pounds and bends approximately 1½ inches before breaking.

TOUGHNESS: Under hydrostatic pressure and the impact of a 50 lb. hammer, ordinary cast iron pipe does not crack until the hammer is dropped four feet (beginning at one foot with one-foot increases).

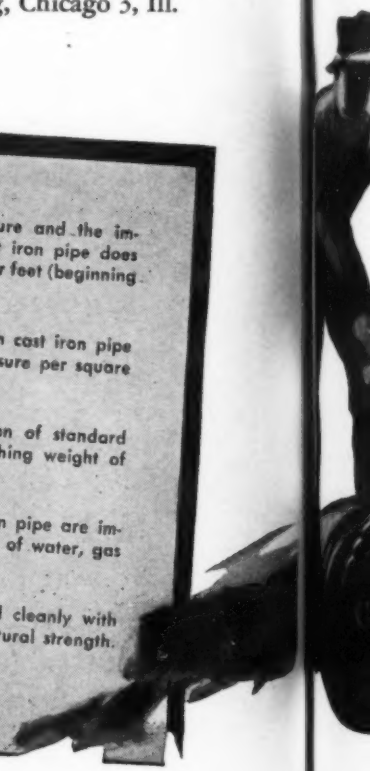
INTERNAL PRESSURE: Standard six-inch cast iron pipe withstands more than 2,500 pounds pressure per square inch.

EXTERNAL PRESSURE: A 12-inch section of standard six-inch cast iron pipe withstands a crushing weight of 14,000 pounds.

IMPERVIOUSNESS: The walls of cast iron pipe are impervious to leakage, seepage or sweating of water, gas or chemicals under internal pressure tests.

TAPPING: Cast iron pipe can be tapped cleanly with strong, tough threads, losing little in structural strength.

Other pipe materials meet some of these requirements but only cast iron pipe meets them all.

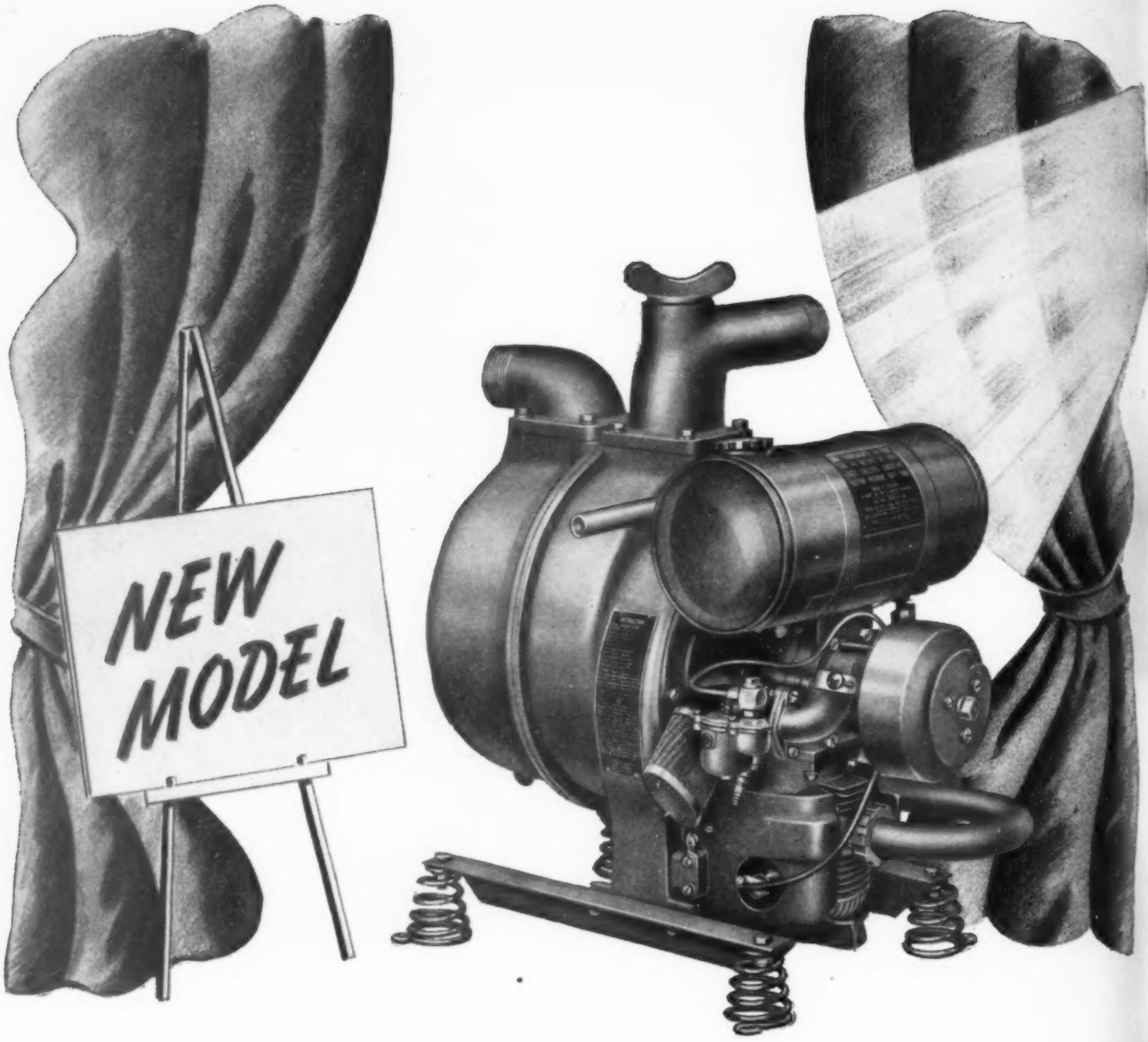


Trust the pipe you know about

CAST IRON PIPE

is the Standard Material

SERVES FOR CENTURIES



NOW you can get a NEW Homelite Portable Pump

The new Model HR Homelite Self-priming Pumps are now coming off our production line.

However, only a few are being built . . . a limited quantity each month for essential civilian use. Your priority rating is your "ration coupon."

True to Homelite standards, these gasoline-engine-driven self-priming pumps are easily portable and extremely rugged. They have a large capacity . . . 28 foot suction lift . . . keep seepage at strainer level . . . and are non-clogging, foolproof and weatherproof. A new engine design gives increased power . . . with a reduction in weight.

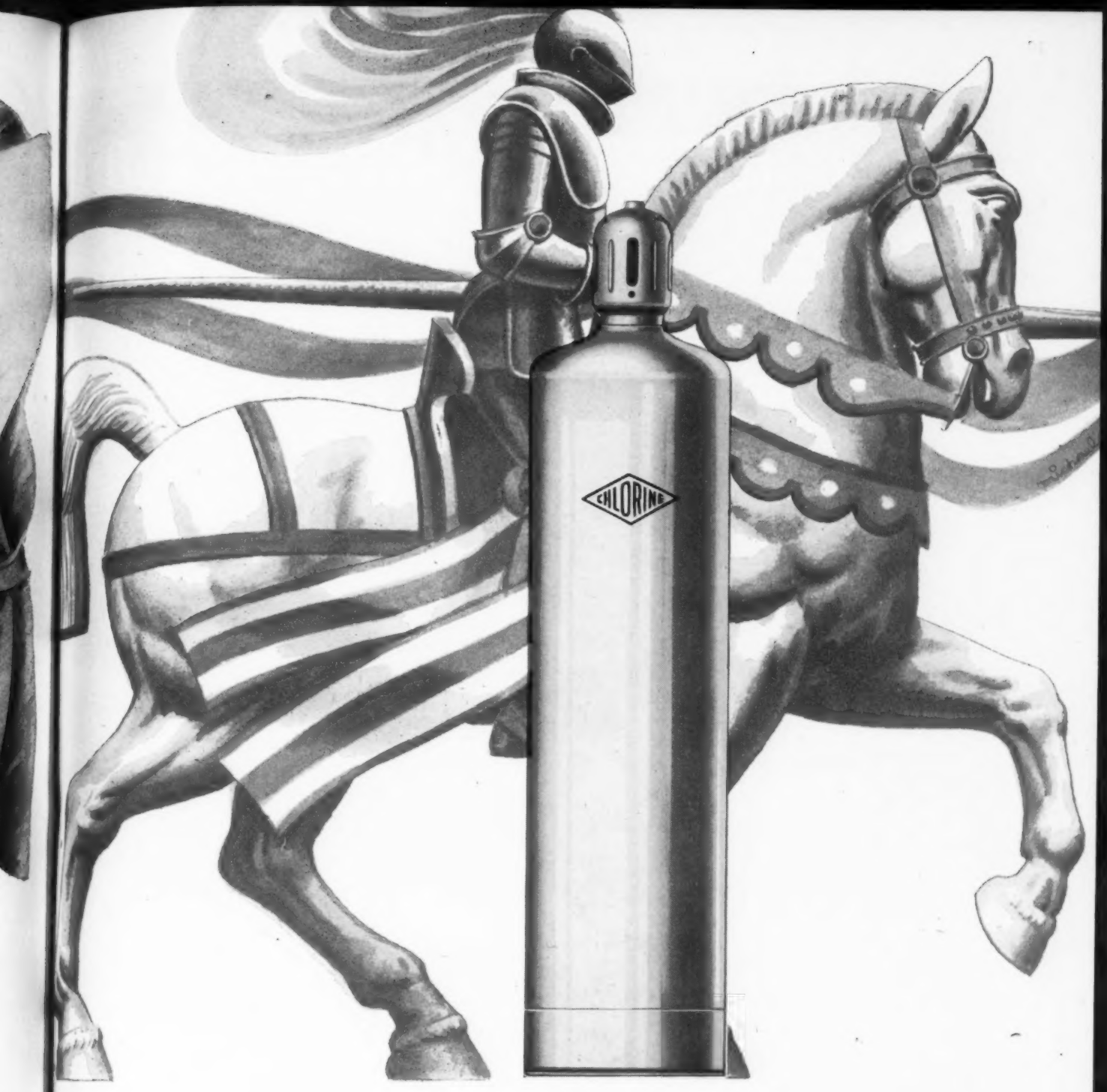
These new Homelite Pumps can be furnished with fittings for 2″ or 3″ hose . . . and the two size fittings are interchangeable.

Write today for complete information and prices on these new Model HR Homelite Portable Pumps. Don't forget to give us your priority rating.

HOMELITE CORPORATION

PORT CHESTER, NEW YORK

***PORTABLE* PUMPS • GENERATORS • BLOWERS**



SAFEGUARD YOUR WATER SUPPLY WITH THE HELP OF

The dependable quality and uniformity of DIAMOND LIQUID CHLORINE is an asset in water treatment and purification. Delivered in single unit tank cars, multi-unit tank cars and cylinders to meet your needs.

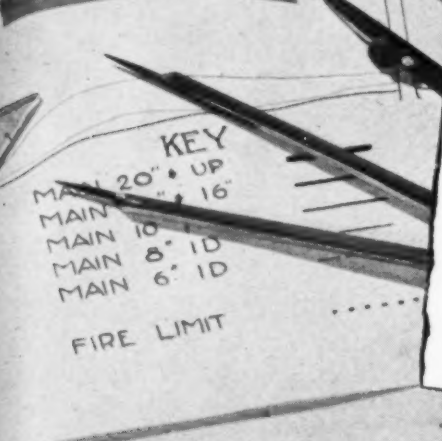
DIAMOND ALKALI COMPANY

PITTSBURGH, PA., *and everywhere*

DIAMOND LIQUID CHLORINE

Wherever Blueprints are
CALIFORNIA
OHIO
MICHIGAN
INDIANA
COLORADO
PENNSYLVANIA
GEORGIA
TEXAS
CLINTON RIVER

being drawn...



TRANSITE PIPE
is pointing the way to efficient, dependable water transportation

BECAUSE its ability to provide efficient, dependable low-cost water transportation has been proved in thousands of installations under every conceivable condition of service, this modern asbestos-cement pipe is getting the call on post-war programs everywhere.

In blueprinting *your* water improvement plans, consider these advantages of Transite Pipe:

No Tuberculation. Because it is non-metallic in composition, Transite Pipe cannot tuberculate. Its initial high flow rate (C-140) can never be choked off by this costly evil. Pumping costs stay low, pressures high.

Low Maintenance. Transite Pipe is made by a special process which develops maximum strength and corrosion resistance. Its proven stability under the wide range of soil conditions encountered in service assures low maintenance.

Easy Handling. Its light weight means fewer men required for handling, more footage carried per truck load, lower installation costs.

Rapid Assembly. Even unskilled crews can assemble Transite Pipe easily, quickly, with the exclusive J-M Simplex Coupling.

Tight, Flexible Joints. Wide sweeps can be made with straight lengths because the Simplex Coupling stays tight even when the line is deflected as much as 5° at each joint.

• • •

Get complete details by writing for Transite Pipe Booklet TR-11A. For details on Transite Sewer Pipe, ask for TR-21A. Johns-Manville, 22 E. 40th St., New York 16, N. Y.

As an aid to planners, the Committee on Water and Sewage Works Development has prepared this 20-page booklet. For your free copy of "Blueprint Now," write the Committee, Suite 2110, 500 5th Ave., New York 18, N. Y.

Johns-Manville *Asbestos* Transite Pipe

FOR EFFICIENT, ECONOMICAL WATER AND SEWER LINES

Patent Notice

Please take notice that United States Patent No. 2,358,222 issued September 12, 1944, has been assigned to National Aluminate Corporation: For your convenience, claims 1 and 15 are reproduced below as being somewhat typical of the 19 claims of this patent:

1 In the art of treating water for industrial consumption, the process of inhibiting deposition of alkaline earth compounds in passageways for the water having a total alkalinity that does not exceed the soap hardness by more than one hundred parts per million, expressed as $CaCO_3$, comprising, adding to the water, a polyphosphoric acid compound in an amount not exceeding nine parts per million and not exceeding thirty-five percent of the soap hardness of the water.

15 The herein described process of treating and heating a water which would otherwise precipitate calcium carbonate upon heating, which comprises, adding to the water a water-soluble molecularly dehydrated phosphate which has a dispersive effect upon calcium carbonate in an amount much less than that required for softening the water and not more than about 9 parts per million but sufficient to prevent the precipitation of calcium carbonate as a result of heating the water together with an organic dispersive agent which has a dispersive effect upon calcium orthophosphate, and thereafter heating the water so treated.

PATENT LICENSES, UNRESTRICTED AS TO SOURCES OF SUPPLY AND MATERIALS, BUT ON A ROYALTY BASIS, WILL BE GRANTED TO THOSE DESIRING TO PRACTICE THE SUBJECT MATTER OF UNITED STATES PATENT 2,358,222. APPLICATIONS FOR LICENSES SHOULD BE MADE TO NATIONAL ALUMINATE CORPORATION, 6218 WEST 66th PLACE, CHICAGO 38, ILLINOIS.

Softened boiler feedwater at 200° F run through tube for 1 hour — incrustration 137 milligrams.

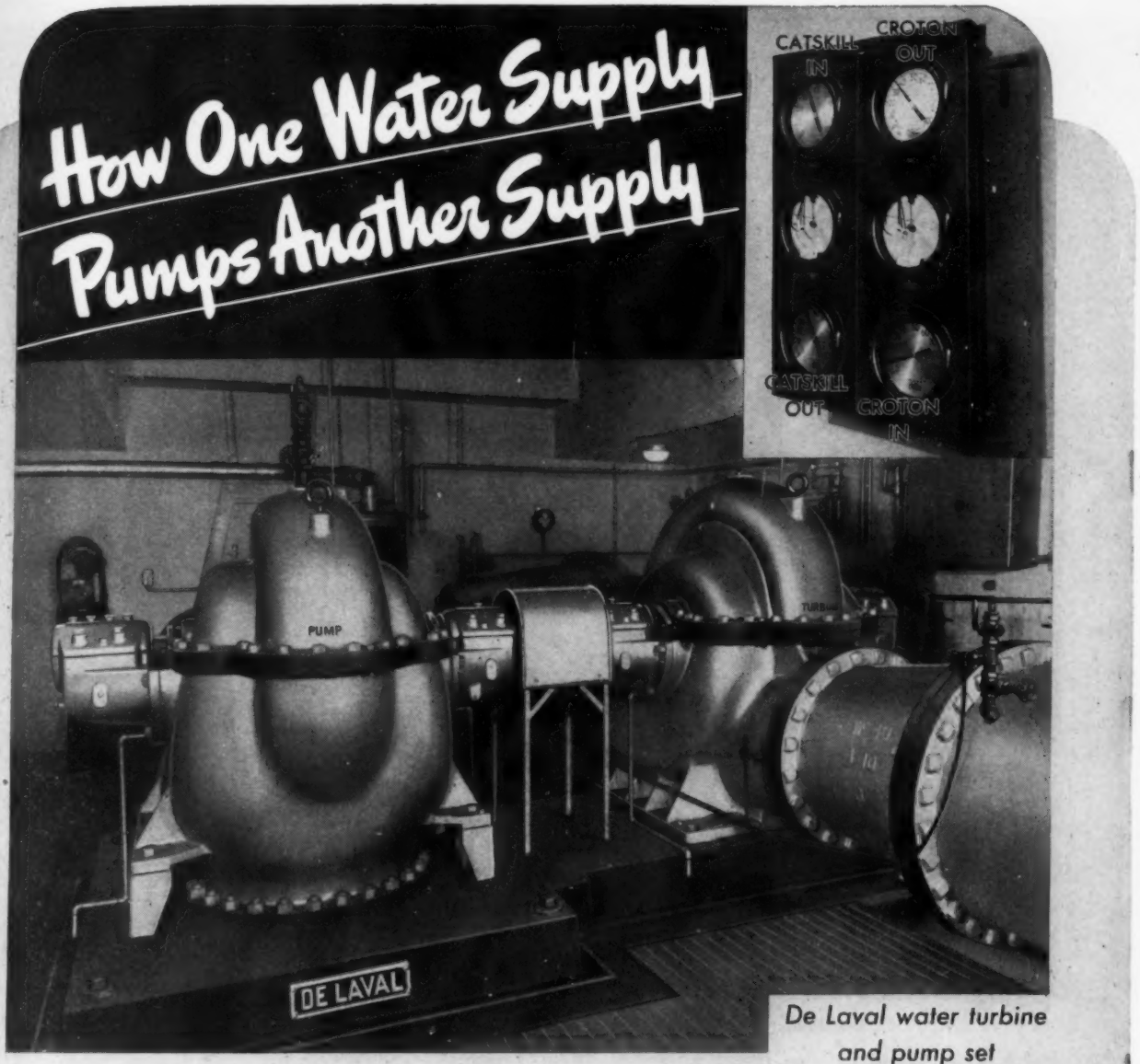
Stabilized feedwater treatment keeps feedwater lines clean — saves time and money and insures maximum economy and efficiency.

Same feedwater stabilized at same temperature run through tube for 1 hour — incrustration 1 milligram.

Nalco

—System of Scientific Water Treating Service . . . for all industry

How One Water Supply Pumps Another Supply



De Laval water turbine and pump set

The De Laval Water Turbine and Centrifugal Pump set here shown is located in a room beneath one corner of the Public Library, 40th St. and Fifth Avenue, New York City. At full capacity the water turbine, receiving 20,800 g. p. m. of Catskill water under 210 ft. head and discharging to its distribution system against 120 ft. head, drives a pump operating at 560 r. p. m., which delivers 21,000 g. p. m. of Croton water to its distribution system against 100 ft. head. The positive head at the suction nozzle is 35 ft. and 392 hp. is delivered by the water turbine.

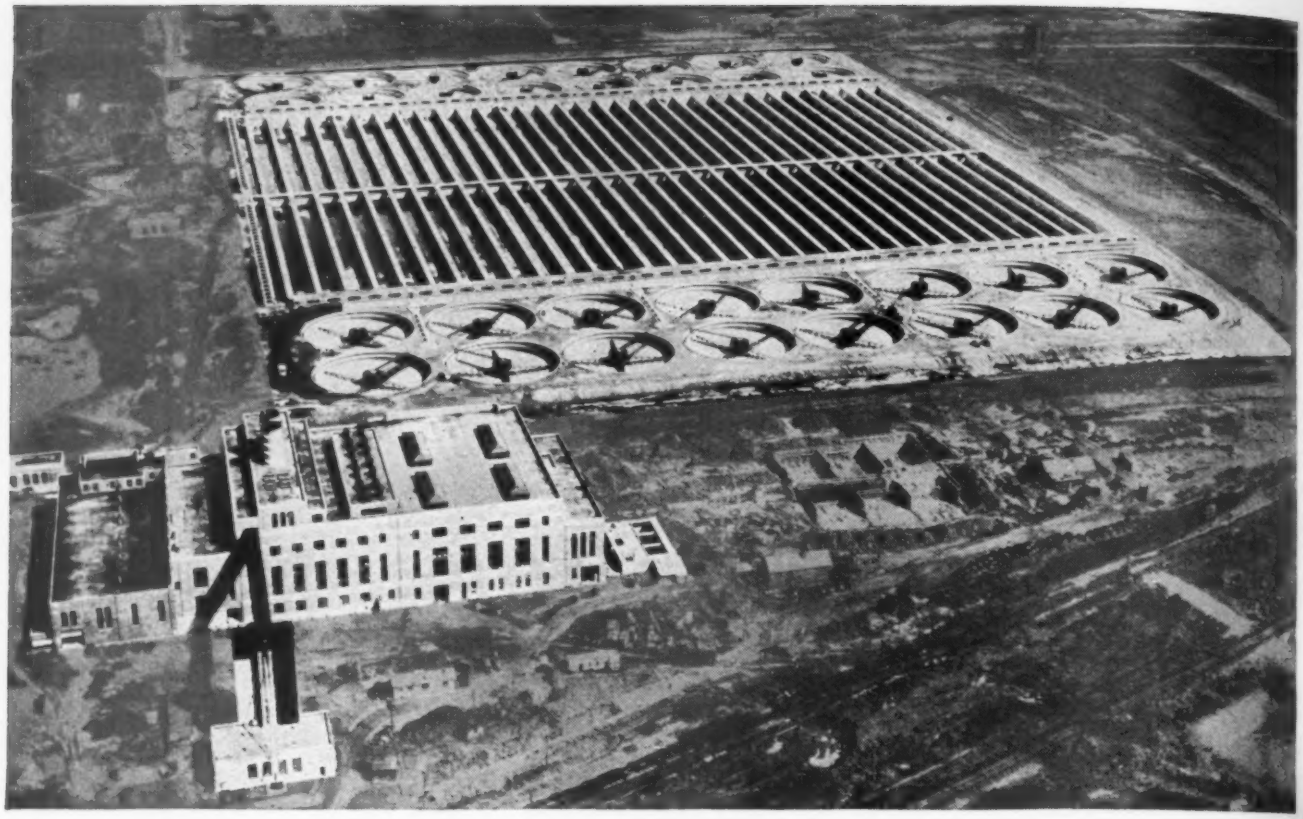
The speed of the unit is automatically regulated by a hydraulically operated throttle valve in the turbine discharge line, actuated by the pressure therein. No particular attention is necessary other than occasional inspection of the lubricating system.

De Laval engineers will gladly help in solving your pumping problems.

4107

DE LAVAL *Steam Turbine Co.*
TRENTON, N. J.

MANUFACTURERS OF TURBINES . . . STEAM, HYDRAULIC. PUMPS . . . CENTRIFUGAL, CLOGLESS, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, PROPELLER. PRIMING SYSTEMS; CENTRIFUGAL BLOWERS and COMPRESSORS; GEARS . . . WORM, HELICAL and FLEXIBLE COUPLINGS



Everdur BEGINS 11th YEAR OF SERVICE IN WORLD'S LARGEST SEWAGE PLANT

FOURTEEN MILES of Everdur* Conduit and 20,000 lb. of Everdur Fittings in Chicago's famous Southwest Sewage Treatment Plant, the largest in the world, are now well into their eleventh year of service under severely corrosive conditions.

Here, as in so many other notable installations, such as Ward's Island and Tallman's Island in New York, San Francisco, Bound Brook, Rahway and Elizabeth in New Jersey; Dearborn, Mich., and Hagerstown, Md., Everdur proves itself through years of dependable service the ideal metal for sewage plant equipment. This copper-silicon alloy combines strength, high resistance to corrosion with ready machinability and weldability. It is available in practically all commercial shapes.

For detailed information on Everdur Metal for sewage treatment equipment, write for Publication E-11.

Reg. U. S. Pat. Off.

Everdur Metal

is used in sewage works for Coarse and Fine Screens, Swing Gates, Built-up Sluice Gates, Coarse Bar Rack Aprons, Effluent Weirs and Scum Weirs, Structural Scum Baffle Brackets, Troughs, Screen Hoppers, Orifices, Baskets, Anchors, Ladders, Float Gage Chains, Valve Springs, Manhole Steps, Guides, Walkways, Bars and Plates, Bolts and Nuts.

ANACONDA

KEEP FAITH WITH YOUR FIGHTERS AND YOURSELF!
. . . BUY WAR BONDS FOR KEEPS

Everdur Copper-Silicon Alloy

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

Key Factors

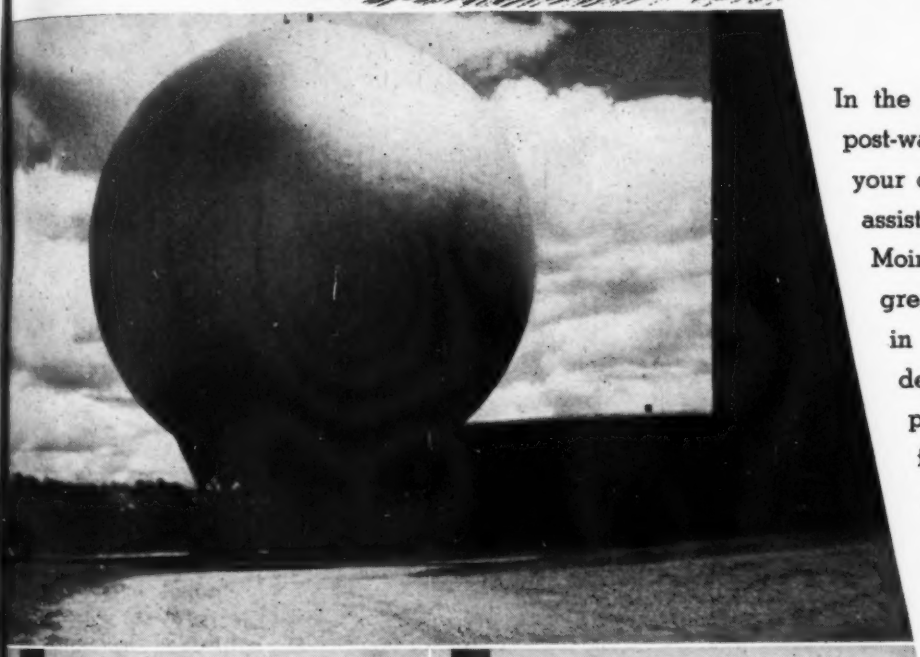
IN YOUR POST-WAR SEWAGE TREATMENT PROGRAM

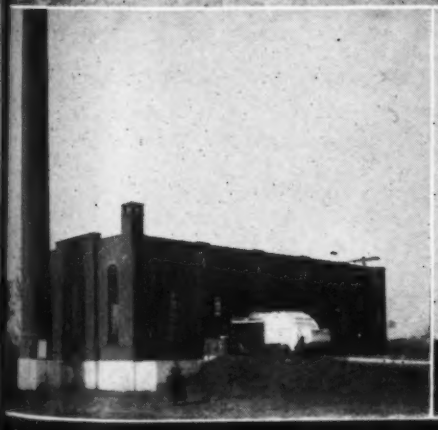
PITTSBURGH •DES MOINES

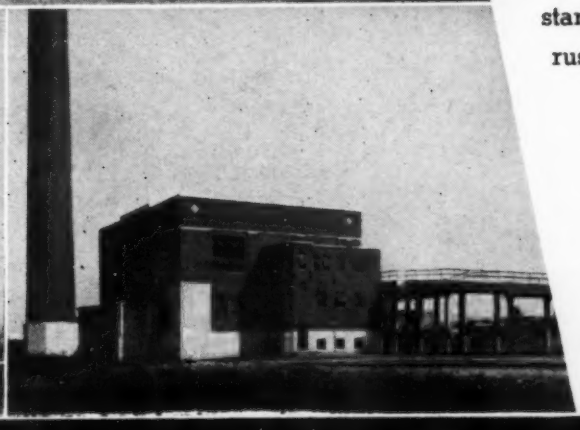
ENGINEERING SERVICE
to aid your planning now

INCINERATION PLANTS
for sludge disposal

PRESSURE SPHERES
for digester gas storage







In the development of adequate post-war sanitation facilities for your community, the engineering assistance of the Pittsburgh-Des Moines organization can be of great value. Our long experience in this field is your assurance of design excellence that fully interprets your requirements . . . our fabricating and construction skills mean better performance and durability in the completed work. May we suggest a consultation *now*—the first step toward a running start when the municipal building rush begins?

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PITTSBURGH, PA., 3418 NEVILLE ISLAND—DES MOINES, IOWA, 919 TUTTLE STREET
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SEATTLE, 526 EIGHTH AVENUE, SOUTH

Is *Your* Town Paying Too Much for Sanitation?

Fairbanks-Morse Pumps Reduce Costs Help Save Taxpayers' Money

TAKE the case of Englewood, N. J.—city officials realized sewage handling costs were too high and careful analysis indicated the need for a new system.

With an eye to the future they built a new plant, replaced the old equipment. Included in the new system were three Fairbanks-Morse Pumps. Two were 4" vertical sewage pumps with 500 and 700 gallons capacity respectively. One was a 5" vertical pump with 1200 gallons capacity per minute.

The Fairbanks-Morse Pumps were so much more efficient that the new plant showed a *ten per cent reduction* in sewage handling costs almost immediately.

Before long, Englewood's new equipment will be paid for by savings. And such cases are frequent. Oftener than not old pumps cost more to retain than to replace. Many officials of towns and cities are planning right now to ease the postwar tax burden of their citizens by savings in municipal services. Your resident Fairbanks-Morse Engineer will gladly help you get such plans worked out. To meet him, write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

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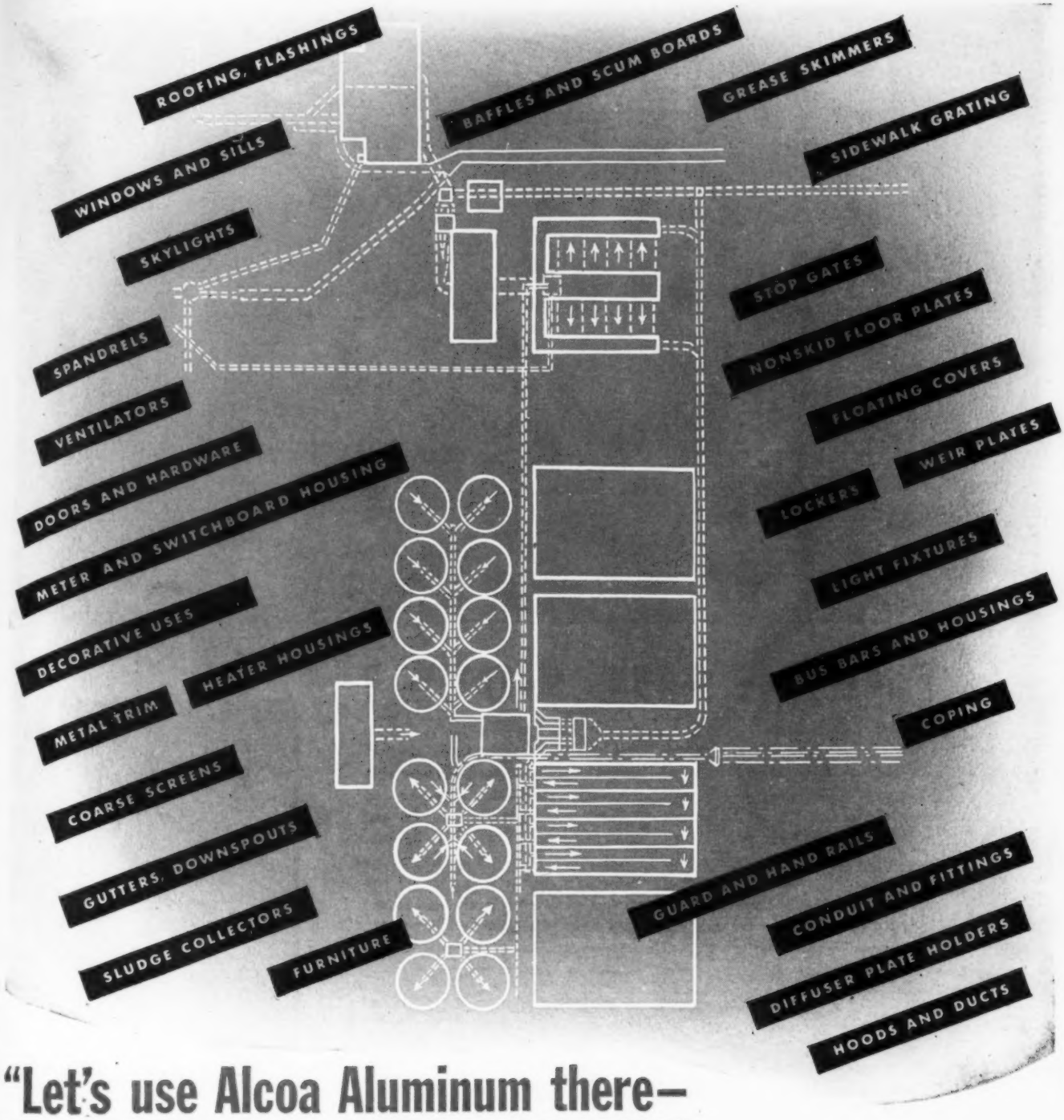
Fairbanks-Morse

A name worth remembering

Diesel Locomotives · Diesel Engines · Generators · Motors · Pumps · Scales
Magnetos · Stokers · Railroad Motor Cars and Standpipes · Farm Equipment



"Let's use Alcoa Aluminum there—

—LONG-LIVED, GOOD-LOOKING, COSTS LESS TO MAINTAIN"

There are Alcoa Aluminum Alloys suited to all of these uses. For evidence that it pays to employ aluminum in sewage plant construction, write ALUMINUM COMPANY OF AMERICA, 1955 Gulf Building, Pittsburgh 19, Pa.

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM

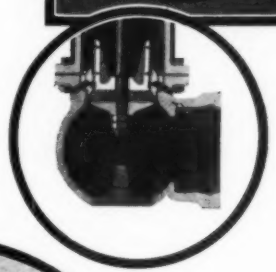
THERE SHE GOES!

And it is a shame, too. It might have been saved, for what at first was only a small blaze turned out to be a major conflagration in a short time. No matter how efficient your firemen may be—no matter how fine are your trucks and equipment, if precious minutes are lost at the scene of the fire, fighting a stubborn fire hydrant, it can mean the complete destruction of many buildings. Delay from any cause—even for a few minutes—is disastrous and causes fire losses to mount.

Make certain that your firemen do not have hydrant trouble by specifying MUELLER-COLUMBIAN Improved Fire Hydrants. With cold weather coming on, here is a hydrant that can withstand the rigors of freezing and ice. The self-oiling bonnet section with the weather-proof cap will not stick, bind, rust or freeze in any climate.

The big feature, however, is the bronze-bushed dual drain valves which are an integral part of the main valve. When the hydrant is closed after using, these positively operated valves drain the barrel completely dry. It cannot ever freeze, assuring you that there will never be delays from ice and freezing. As a further protection, when the main valve is first opened, water under pressure is forced through the drain openings for an instant and all foreign substances are washed out thus making certain that drain ports are always open. A dry barrel is never subject to rust and freezing.

For description of the many other features that can save your city money write for our new MUELLER-COLUMBIAN Improved Fire Hydrant Folder just off the press.



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MUELLER-COLUMBIAN
FOUNDED 1857

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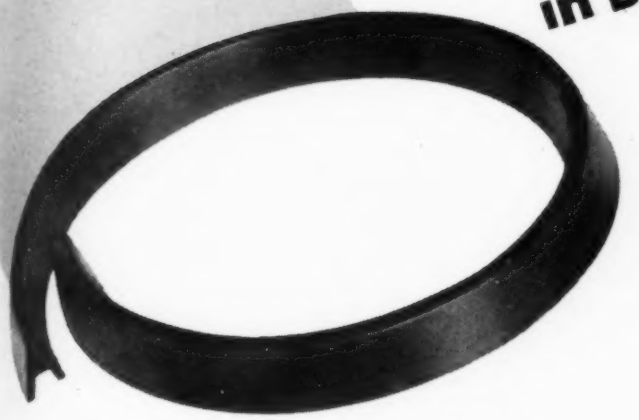
BUY MORE WAR BONDS

GET THE HYDRANT FIREMEN PREFER

Atlas Announces

An Important Improvement in Bell & Spigot Main Jointing



SPEEDS STERILIZATION OF LINES

FACILITATES REPAIRS

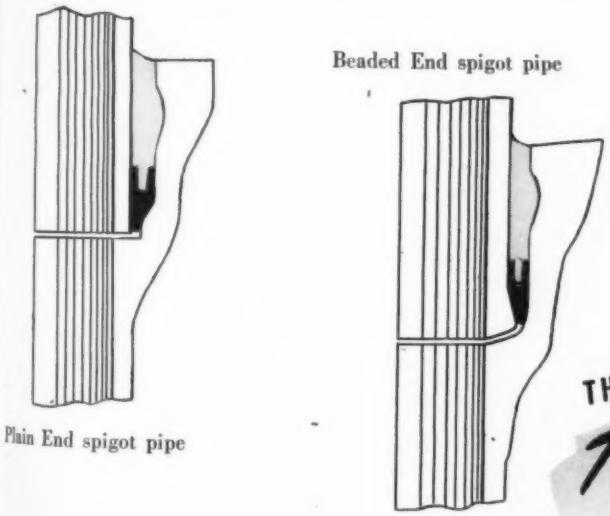
EASILY APPLIED IN MAKING JOINT

The HYDE-RO Ring

...cut to show cross section

This simple, wedge-shaped rubber ring is easily and quickly caulked into the joint, as shown in diagram. Since rubber is non-porous, the HYDE-RO Ring does not harbor bacteria, nor can it contaminate water in the line. The first hypochlorite flushing invariably secures negative reaction.

When line repairs are necessary and gate valves do not close tightly, the snug-fitting HYDE-RO Ring dams off leakage, *permitting pouring of dry joints.*



Cross sections showing the HYDE-RO Ring caulked into position.

Application requires no skilled labor. No measuring or cutting is needed. No laps to be inspected. Wrong size cannot be used. Same ring fits beaded or straight end pipe. Caulking tool automatically slips into groove on back of ring.

Can be used with *Tegul*-MINERALEAD, lead or Portland Cement.

The permanency of rubber in water stands proven by long years of use. Sealed away from the deteriorating effects of air and sunlight, you may expect the HYDE-RO Ring to last indefinitely.

The HYDE-RO Ring is now available for pipe of 4 to 12" diameters. Write us here at Mertztown for complete information.

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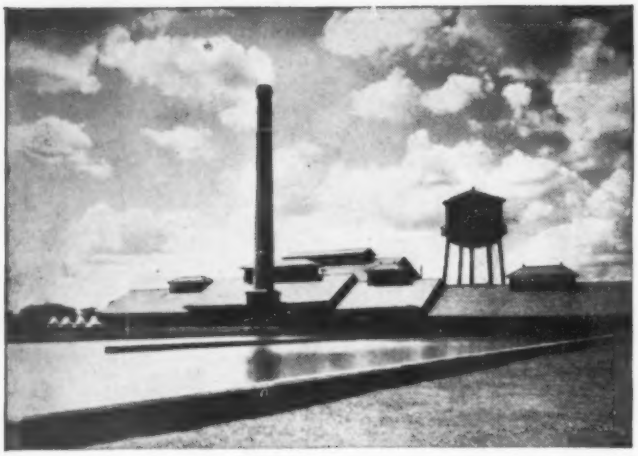
GENERAL CHEMICAL "ALUM"

. . . EQUALLY EFFICIENT FOR COAGULATION OF *WATER and SEWAGE!*



Today, aluminum sulfate is almost universally accepted by water experts as the best coagulant for the removal of turbidity, color and bacteria from water . . . and General Chemical Aluminum Sulfate is the outstanding choice the nation over. The reason? Operating men have come to rely on its high quality and constant uniformity, knowing that the effectiveness of General Chemical Alum has been "proved in settling basins all over America."

Municipal officials in charge of sewage disposal find that clarity and purity of sewage effluent are also easily obtainable with General Chemical Aluminum Sulfate because of the many reasons noted below. Why not join the majority of American cities that prefer General Chemical Alum—and specify "General" for your requirements?

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2. Gives better floc formation resulting in longer filter runs.
3. It is a low-cost coagulant.
4. Has no chlorine demand, conserving chlorine exclusively for disinfection.
5. Superior in tests against other coagulants.
6. High in quality, its constant uniformity can be counted upon.
7. Aids in the reduction of tastes and odors.

★ FOR SEWAGE PLANTS

1. Clean, easy to handle, dry feeds well, and economical to use.
2. Simple application, requires only low cost feeding apparatus and minimum attention.
3. Clear, colorless effluents are possible.
4. Sludge digests readily.
5. Treated digested sludge dries quickly, with a minimum of odor.
6. Chlorine consumption is cut due to lower demand of clarified sewage.

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Left: Interior view of FLOCTROL tanks showing arrangement of compartments and paddle wheels.

Above: A group of Jeffrey-Traylor WAYTROLS (constant weight feeders) in the water purification plant, Toledo, Ohio.

Left: Mechanically-cleaned SCREENS and GRIT COLLECTORS at Detroit, Michigan.

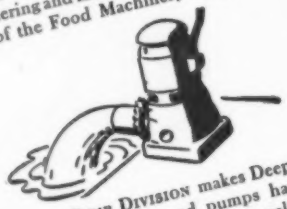
JEFFREY

ESTABLISHED 1877

The FMC Fog Fire Fighter is another Product of the Company that makes

Peerless Pumps

Back of every FMC product is the research, engineering and manufacturing resourcefulness of the Food Machinery Corporation.



PEERLESS PUMP DIVISION makes Deep Well Turbines, Hi-Lifts and pumps handling water for every purpose. Los Angeles, San Jose and Fresno, Calif.; and Canton, Ohio.

FMC Original *Fog Fire Fighters*

EXTINGUISH HOT FIRES WITHOUT USUAL WATER DAMAGE!

By atomizing plain water at extreme high pressure (600 pounds at the nozzle!), this revolutionary equipment produces a dense, smothering and cooling fog that quenches even oil and gasoline fires with miraculous speed...and with minimum water damage.

Because of this equipment's phenomenal success in extinguishing all types of fires, use of high pressure fog is now an accepted part of the most up-to-date fire fighting technique. A special type of FMC Fog Fire Fighter was developed by Food Machinery Corporation for Army and Navy use in combatting the most difficult fires. After the war, city and rural fire fighting units all over America will use FMC Fog Fire Fighters to do a better job of saving lives and property... one more way in which FMC's designing, engineering and manufacturing resourcefulness will serve the nation.

Other FMC Divisions and Typical Products

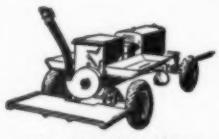
ANDERSON-BARNGROVER DIVISION. A complete line of machinery for canning foods. San Jose, Calif.

TEXAS DIVISION. Produce Packing Equipt., Canning Machinery, Flavorseal & other processes for fresh produce. Harlingen, Tex.

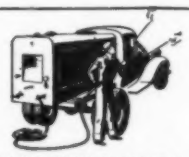
FLORIDA DIVISION... Produce Packing Equipment ... Flavorseal Protection & other processes. Dunedin & Lakeland, Florida.

SPRAGUE-SELLS DIVISION. A full line of equipment for nearly every packing operation on many types of foods. Hoopeston, Ill.

RIVERSIDE DIVISION. Produce Packing Equipment and Protective Processes, Automatic Box Making Machines. Riverside, Cal.



THE NIAGARA SPRAYER & CHEMICAL CO., INC. DIV. Insecticides. Middleport, N.Y.; Jacksonville, Florida; Burlington, Ont., Can.



JOHN BEAN MFG. CO. DIV. AND BEAN-CUTLER DIV.... also make Bean Orchard & Crop Sprayers. Lansing, Mich. and San Jose, Calif.

FMC's "WATER BUFFALO" amphibious tanks. Seven of FMC's fourteen major plants make amphibious tanks or sub-assemblies.

FOOD MACHINERY CORPORATION

EXECUTIVE OFFICES: SAN JOSE, CALIFORNIA

FMC Fog Fire Fighters are made by John Bean Mfg. Co. Division, Lansing, Michigan and Bean-Cutler Division, San Jose, California

LAKELAND
RIVERSIDE
HOOPESTON
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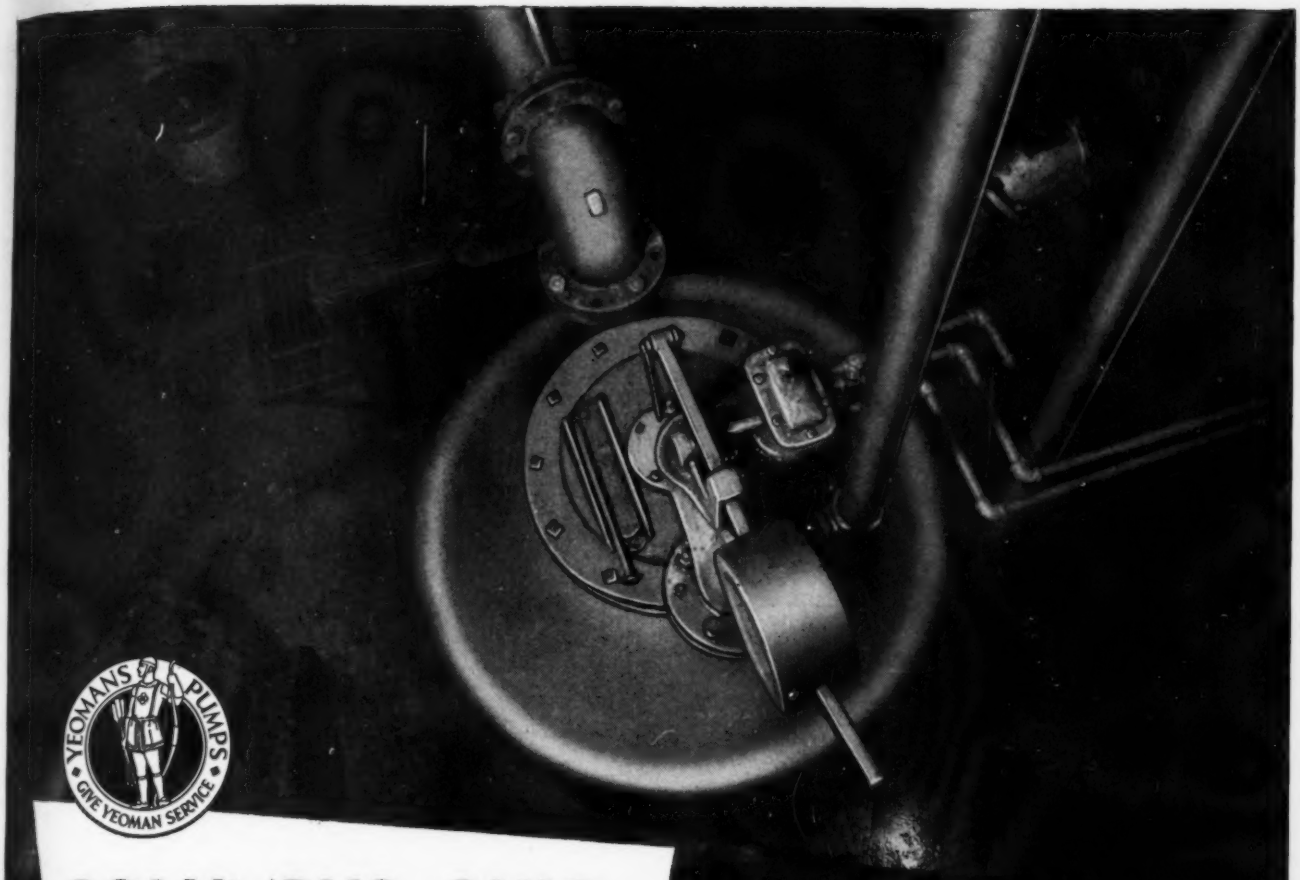
SAN JOSE



YEOMANS PUMPS • GIVE YEOMAN SERVICE •

COLUMBUS, OHIO, whips the scum and grease nuisance with

YEOMANS SHONE PNEUMATIC EJECTORS ...Pumping steadily, smoothly, effectively since 1937 ...no trouble!

HERE is the old familiar problem—irritating, costly: pumping scum and grease from the primary settling tank—same problem as pumping sludge.

No pump does this job efficiently. Solidified grease clogs and stops the pump.

Columbus, Ohio, found the right solution, as have many municipalities and sanitary bodies—Yeomans Shone-Type pneumatic ejectors. At Columbus treatment plant, two ejectors are used, one at each end of the settling tank. Flights feed the skimmings into hoppers. They handle an estimated 10,000 gallons per day—have been doing it steadily, effectively, year after year since 1937, with a minimum of attention. Troubles—none.

Full details of the Columbus installation and Bulletin 4003 will be sent on request—explains why this extraordinary unit is better for pumping hard-to-handle materials. Use the coupon.

YEOMANS BROTHERS COMPANY
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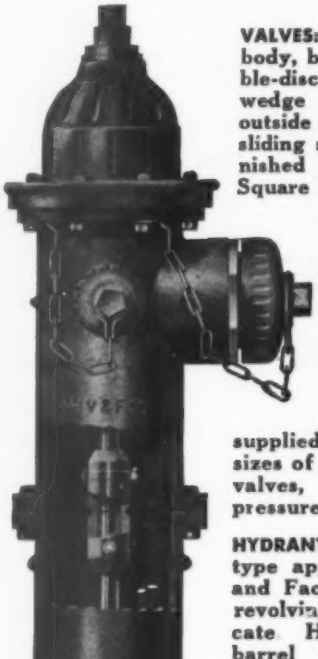
SEND THE COUPON . . . . . *There's No Obligation*

Please give us additional information on how Yeomans Shone ejectors can be used for pumping grease and scum.

Name_____
Address_____
City_____ Zone_____
Firm Name_____

The Sign of QUALITY!

VALVES HYDRANTS



VALVES: A.W.W.A. type, iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position. All rugged and dependable, made of best material with highest quality workmanship.

Hydraulically Operated: For remote control of operation and for quicker, easier opening or closing. Can be supplied in any of the standard sizes of M & H A.W.W.A. gate valves, either high or low pressure.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals. Dry top, revolving head, easy to lubricate. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway. SPECIAL TRAFFIC MODEL is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem.

Write for Catalog No. 34

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FIRE HYDRANTS	SHEAR GATES
GATE VALVES	MUD VALVES
TAPPING VALVES	VALVE BOXES
WALL CASTINGS	FLAP VALVES
SPECIAL CASTINGS	SLUDGE SHOES
TAPPING SLEEVES	FLANGE AND FLARE FITTINGS
CHECK VALVES	FLANGED FITTINGS
FLOOR STANDS	B & S FITTINGS
EXTENSION STEMS	CUTTING-IN TEES

M & H VALVE AND FITTINGS COMPANY

ANNISTON, ALABAMA

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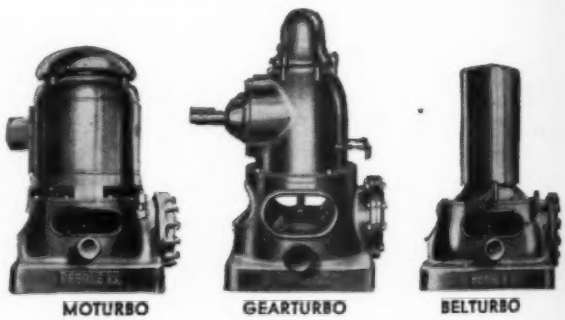
FEATURES — *(Turbine Type)*

Water-cooled head bearings • Choice of oil or water lubrication • Double Bearings in each bowl • Fully-enclosed impellers • Double Seal impellers.

PEERLESS PUMPS

Capacities—10 to 220,000 gallons per minute



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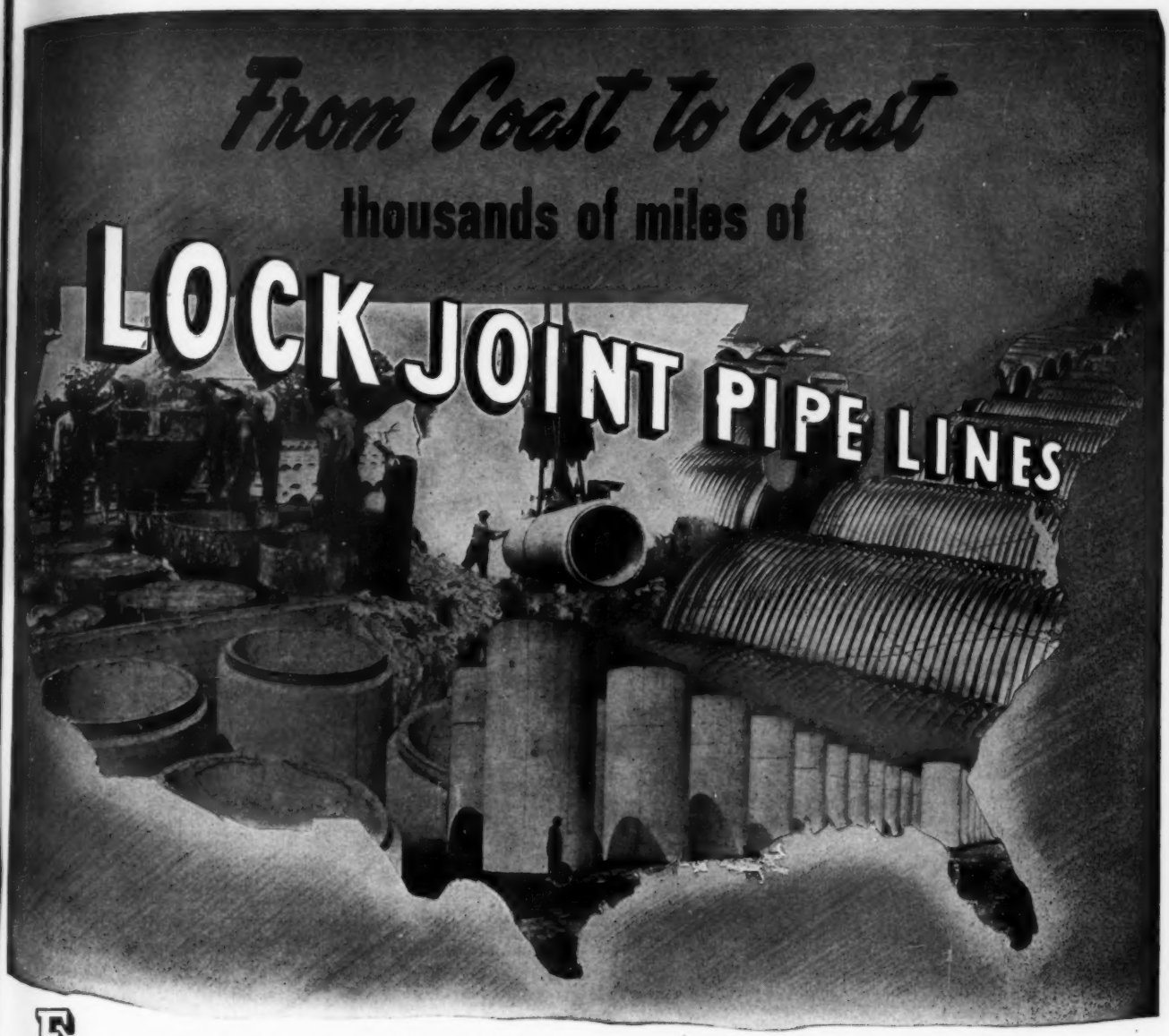

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Leading water works engineers are definitely agreed that these highly efficient pipelines can absolutely be depended upon for strength, easy installation, adaptability, safety, high carrying capacity, water-tightness, long life and economical service.

In peacetime Lock Joint Pipelines are built with an eye to long-range programs and are recognized as the best method of constructing large diameter, high pressure water supply mains. In wartime, they offer a 25% to 75% saving of critical materials on 100% critical jobs.

The history of our many installations is the best proof of the lasting qualities built into every mile of Lock Joint Reinforced Concrete Pressure Pipe.

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Whether your project is large or small, for the present or the future, your 'phone call, telegram, cable or letter to any of our offices will bring a prompt reply.

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Established 1905

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SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

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Reinforced Concrete
PRESSURE PIPE

for

CHEMICAL FEEDERS YOU CAN DEPEND ON

Specify %PROPORTIONEERS%

Lifesavers to busy waterworks operators are these accurate, rugged chemical feeders! Over 16,500 installations of %Proportioneers% are serving faithfully, establishing records for dependable and precise chemical feeding in water sterilization and purification.

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TREATING AT CONSTANT RATE

Motor Driven Manual Adjustment %Proportioneers%, with feeding rate adjustable while pump is operating.

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TREATING AT VARIABLE RATES

Hydraulically Operated Automatic Adjustment %Proportioneers%, for high or low pressures.

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155 East 44th Street, New York, N. Y.
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COMING!

Cathodic Protection of Sewage Works Equipment

Cathodic protection of submerged metal surfaces is a corrosion and electrolysis prevention process. In our next issue an article describing the practical application of this electrochemical process to important units of a sewage treatment plant, with clearly demonstrated evidence of the value of this comparatively untried method of checking corrosion in sewage treatment units. This feature article is the contribution of—

A. B. KOZMA, Supt.,
Joint Sewage Treatment Works, Rutherford, N. J.

Fire Hydrant Discharge Measurements

Is a companion article to an earlier contribution by the same author. His article in our December issue describes the pressure gage method and a special gage for the purpose. The forthcoming article describes another method of making hydrant flow tests when the volume is relatively low. The simplified method and the equipment required are described by—

A. A. HIRSCH, Director,
Section School on Water Supply and Sewerage,
Baton Rouge, La.

Corrosion of Iron by Sulfides

Is an article which presents a number of typical cases wherein sulfides contained in the water, sewage, or sludge have been the cause of corrosion of iron. The phenomenon of sulfide corrosion, which is not an infrequent occurrence, is of practical importance and the principles of its action as well as suggested remedial measures are discussed in this paper by—

RICHARD POMEROY, Consulting Chemist,
Pasadena, Cal.

Locating Water Leaks by Modern Methods

Is a story from Buffalo where one leak, amongst others, was run down to the tune of a stop-loss of 1,750,000 gpd. How Buffalo locates main and service leaks is told by—

ALAN DRAKE, Director of Water,
Buffalo, N. Y.

Cleaning Mains and Wells With Compressed Air

Is the story of a novel use of an air compressor for removing sand from wells and the air-shooting of a supply main to remove encrustation and increase its capacity. This simple labor and time-saving scheme is as interesting as it is economical and effective. The author and developer of this scheme is

ROSCOE R. HOWARD, Supt.
Municipal Utilities, Slater, Mo.

Estimating Variations in Sewage Flow

Has never followed a uniform practice by designing engineers. This has been true because relatively meager or limited information has been available on both maximum and minimum flows, both of which are important to design considerations. By correlating existing data it has been possible to develop normal fluctuation in flows, and a nomograph to determine these flow variations has been prepared by

H. M. GIFFT, Assoc. Prof. of
Sanitary Engineering,
Cornell University, Ithaca, N. Y.

Porous Plate Filter Bottoms

Presents the story of the porous plate false bottom for rapid sand or anthracite filters, and its success. This article reviews the merits of the porous bottom, which requires no lateral piping or supporting gravel bed, and is essentially fool-proof. An impressive listing of successful installations and representative pictures adds interest to the story by

FRANK C. ROE, Engineer,
The Carborundum Co., Perth Amboy, N. J.

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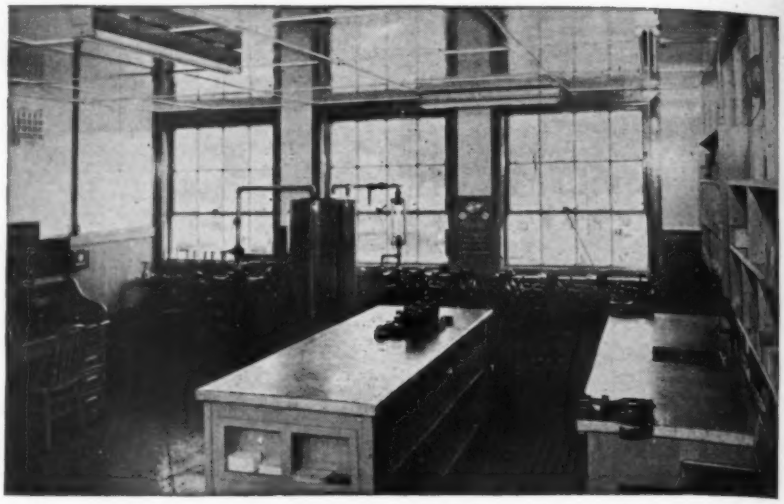

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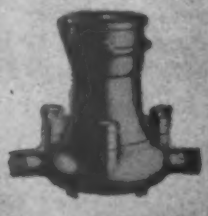

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WATER WORKS & SEWERAGE

VOL. 92, No. 3 *A Gillette Publication* MARCH, 1945

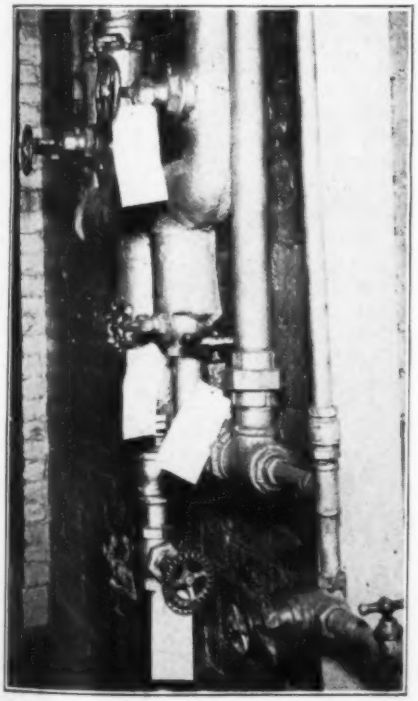
ELIMINATION OF CROSS-CONNECTIONS IN LOS ANGELES

More Than 40,000 on 2000 Properties Cost Upwards of $2,000,000

By R. F. GOUDEY
Sanitary Engineer
Department of Water and Power
LOS ANGELES

THE City of Los Angeles has eliminated over 40,000 cross-connections, since the outbreak of the war, in its program to protect domestic water at harbor waterfront properties, military facilities, federal housing projects, and war production plants. The project involved the installation of 10,000 vacuum breakers on plumbing fixtures, the raising of 21,000 inlets to give air-gap protection, the breaking of 2,000 direct connections to sewers, and the installation of over 2,300 backflow mechanical devices on pressure lines. The work involved over 2,000 properties, 1,200 different owners, and exceeded a cost of $2,000,000.

The Author

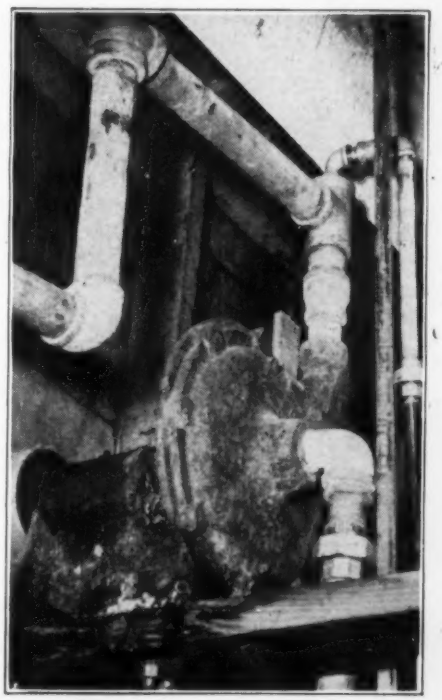


1-in. City Water Line (right) Cross-Connected to 2-in. Boiler Feed Water Header on Pump Discharge (left).

Historical Development of Cross-Connection Protection

From 1930 to 1938 the Department of Water and Power carried on a program to eliminate plumbing hazards and all types of cross-connections. With cooperation of the Building and Safety Department, an ordinance was passed in 1938 covering the installation of approved vacuum breakers on the discharge side of water inlets to plumbing fixtures, much as is covered by the most progressive plumbing ordinances throughout the country. The program at that time involved complete separation of potable and non-potable water piping systems and supplies. A few large size fire services were permitted to have double check valves where special specifications were followed as to tight closures and material used, but their general adoption was disapproved.

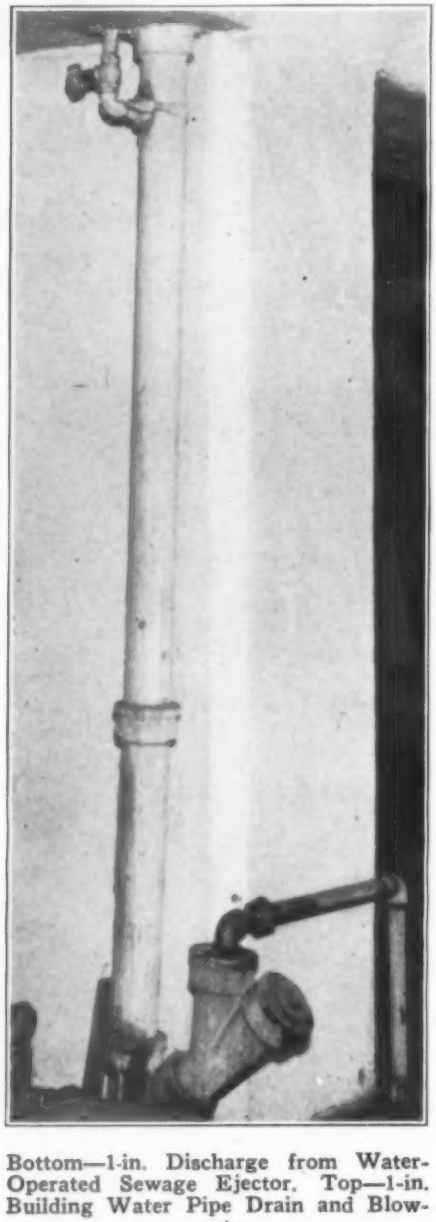
Early in the program it was recognized that the policy of requiring complete separation was not only overly expensive but gave fictitious protection. It was found at photographic and plating plants where air gap protection had been obtained, that in subsequent in-



2-in. Salt Water Pump with 1-in. City Water Priming Line on right (no valve in picture).

spections hoses had been placed on the inlets to avoid splash and to secure mixing. At waterfront properties where fresh water connections to salt water pumps and salt water piping systems had been broken, new connections had been made because it is imperative to flush combination fresh and salt water lines after every period of salt water use.

On oil well leases where tanks with rim discharge inlets and pumps had been installed to prevent backflow from



Bottom—1-in. Discharge from Water-Operated Sewage Ejector. Top—1-in. Building Water Pipe Drain and Blow-out.

oil well drilling operations and from boiler use, cross-connections were invariably made around the air-gap protection in order to secure city water pressure for fire protection. As long as property owners have what they consider as legitimate incentives to use city water under pressure, just so long will there be danger of surreptitious cross-connections being made. Based on these experiences, it is believed that *—only by the proper installation of dependable mechanical devices will domestic water piping systems ever approach safety.*

Development of Mechanical Devices

The development of mechanical devices to safeguard domestic water lines has been discouragingly slow. Superior types of double check valve installations, except for some improvements in pins, bushings and clapper seat material, are fundamentally the same as they were twenty-five years ago. Double check valves have never been generally accepted as adequate protection between safe and unsafe water supplies, largely because the forces creating backflow are neither controlled nor dissipated.

An effort was made to install pressure differential relief valves which would provide openings to atmosphere under backflow conditions. An "Economy" valve was developed for this purpose but did not prove satisfactory. A device with an automatic opening to atmosphere represents a most fruitful field for immediate exploitation because it destroys backflow possibilities into the water supply. Some consideration was given to a number of "switch-over" type valves to separate two supplies but which do not separate their piping systems and consequently permit polluted water to backflow after resets. It appeared, therefore, that entirely new devices would be needed and manufacturers rose to the occasion.

Backflow Pressure Protective Devices

The first backflow pressure protective device was a semi-manual operated Entriken valve installed at a Los Angeles swimming pool in August, 1933, followed a few months later by a second installation at another swimming pool. It provided an air-gap and back-pressure check but was not automatic. In 1938 Mr. Frank Carlton conceived of changes whereby with the addition of a vacuum breaker and the inclusion of a bellows-operated pressure differential relief valve, the device could become automatic.

With additional structural improvements this valve became the E-C Valve No. 3 for sizes ½-in. to 4-in. and was extensively used from 1939 to 1943. In 1942 an E-C Valve No. 5 was developed and one was installed which is yet the very latest in backflow protection, but is too costly for the average installation. A streamlined E-C Valve No. 6 appeared in 1944, incorporating many of the latest and best features in backflow protection and for more critical conditions has superseded the E-C Valve No. 3.

Two other companies entered the field during 1939-40. One was the Schaffer Engineering Company which submitted the Empire valve. This device met test requirements but was too costly to commercialize. The second was the Ross Combustion Engineering Company which produced a valve in ½-in. to 2-in. sizes for use on boiler, steam, and hydraulic elevator lines. For the protection afforded, this valve still is superior from the standpoint of cost.

The Clayton Manufacturing Company next entered the field and by 1943 was an active competitor. The company specializes in check valves and altitude control valves and combined them to make up an assembled backflow protection unit employing standard equipment. Their first unit (Clayton No. 15), included two check valves, a vacuum breaker, and a pressure differential relief valve which operated on the same principal as the E-C Valve No. 3. A second development was a unit (Clayton No. 1) in which both checks were power operated. This device when adjusted to give positive air-gap protection under reverse flow conditions approaches the best type of protection available. Both types of valves have been widely installed during the current year.

Three national concerns have submitted devices during the past year but only one of these companies was successful in producing an approved valve. This is a Hersey No. 2 unit which includes two fire detector check valves, a vacuum breaker, and a pressure differential release valve. It locally meets the requirements of the Board of Fire Underwriters and some units have already been installed.

As the reliability and availability of backflow prevention units gained ground, the previous rigid policy of complete separation of potable and non-potable supplies and piping systems relaxed. Experience so far has completely justified such action. A practice of "industrializing" lines at large plants was instituted. In plants having a large number of cross-connections, a point in the domestic system was selected for the installation of a backflow prevention device to isolate the majority of cross-connections. The former section of the domestic system beyond the device was identified by color bands and by posting at each outlet to designate it fully as an industrial line.

All former domestic water outlets were transferred to safe domestic lines and in some cases short extensions were found necessary. This practice greatly reduced the cost of over-all protection and gave the consumers the greatest use of the city supply with no incentive to make additional cross-connections. This policy was followed out in all new construction at the many shipyard and war production plants which shortly followed with an enormous saving in critical material.

Desirable Features in Backflow Protection Units

Some of the desirable features of satisfactory backflow protection units are:

(1) Provision for a central zone in which there is at all times less pressure than on the inlet side by providing a

pressure differential release valve which opens the central zone to atmosphere with an operating head less than the initial loss-of-head past the inlet check, except when the city pressure is at or less than 2 lb. per sq. in.

(2) A drain connected to the pressure differential release valve sufficiently large to waste a reasonable amount of leakage past the outlet check without building up a head in the central zone of more than 2 lb. per sq. in. pressure when the inlet pressure is zero.

(3) No excessive spitting of water because of sudden drops on the inlet side.

(4) Control diaphragms in duplicate with a vent to atmosphere between them to avoid any danger of a cross-connection being created by diaphragm failure.

(5) Vacuum breakers included where the location of the device is at high points in the piping systems or where pumps take a suction on the inlet side of the device.

(6) Some visible positive sequence such as an alarm or water spurting to atmosphere to indicate any failure of any functioning part of the device.

(7) A location so the device will not be flooded.

(8) Adequate protection against damage from ice in freezing weather locations.

The earlier devices, including the Hankin Valve of Montreal, contain intermediate zones of higher pressure under backflow conditions than exist on the inlet side. This is objectionable because in case the inlet check leaks as much or more than the discharge check, the relief valve cannot open and backflow is unchecked. The trend, therefore, is toward the use of installations having protection zones of less pressure than on the inlet side.

Cross Connection Research

The University of Southern California has established a $30,000 Foundation on Cross-Connection Research and Testing in which it is hoped that the basic principles of backflow protection can be properly evaluated; that all mechanical devices can be made correct from an engineering standpoint; and that adequate test rules can be formulated. A laboratory for this purpose is nearing completion. The Foundation is backed by many manufacturers of national standing, by local and national master plumbers organizations, and by individuals familiar with the problem.

The war speeded up cross-connection work. Only three men were engaged in it from 1930 to 1941 inclusive, although by the end of this period cooperation had been secured with other city departments so that the net effect was the equivalent of more than three men.

Cross-Connection Central Committee

During the spring of 1942 in order to have a more aggressive program and a more uniform city policy for new construction, as well as for existing installations, a Cross-Connection Control Advisory Committee was created by a joint resolution of four Los Angeles city departments covering health, water, building and safety, and mechanical engineering. The program at its peak included eighteen inspectors.

The resolution set up the author as Chairman, and Mr. Roy O. Van Meter as Chief Inspector. The Department of Water and Power furnished office space, an office engineer, and a field supervisor. The plan included assignment of twelve plumbing inspectors with rotation of others for instruction and training purposes in field work and these men were paid by the Dept. of Water and Power.

The Health Department at times assigned up to four men for instruction. All inspectors were cross-deputized so that police power was available regardless of the type of cross-connection discovered. Later this deputization was declared illegal but this decision came too late to interfere with the program.

¾-in. By-pass Installed Around Air Gap Tank and Hidden in Grass.

The resolution required that the Committee develop a unified program and so far as possible to proceed on a broad educational basis.

The merits of the cross-connection program were carefully explained to each plant owner on the basis of health protection and added security. It has not been necessary in any case to resort to legal action. The educational program has been carried to the point where plumbers, insurance agents, boiler inspectors, hospital managers, equipment manufacturers, and federal security officers, have become conscious of the need of backflow protection and have actively participated in the work. The records indicate that 45 per cent of the pressure type of backflow prevention devices installed in Los Angeles were the result of this cooperation.

The Committee took cognizance of the effect that cross-connections might have on the war effort and immediately intensified its program. First, a complete survey was made of the waterfront area at the harbor which included Navy, Coast Guard, Army, Air Corps, petroleum, and shipyard facilities. Secondly, a complete survey was made of all war production plants throughout the city, including all aviation plants, refineries, metal industries, colleges, housing projects, and all other plants on "Master Responsibility Lists." Thirdly, investigations were made of all new water services.

Early in the program there were several cases of waterfront pollution affecting military personnel because of carelessness in the use of pierhead outlets. Los Angeles has had no case of backflow for nine months which is a remarkable record when compared with what is happening at other ports similarly engaged in the war effort.

Elimination of Cross-Connections

Very careful consideration must be given to thoroughness in making inspections, care in office review as to requirements and remedies applicable, and presentation of recommendations to management if success is to be attained in cross-connection elimination. The following procedure was carefully exercised.

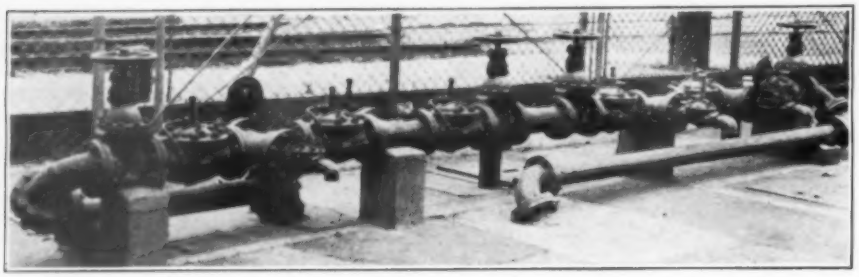
1. Before making any field inspection, the following preliminary steps were taken:

(a) A tracing of the area to be surveyed was made from a district sheet of the Water Dept. giving on a scale of 100 feet to the inch, the size of street mains, location, service numbers of the water services, and similar pertinent data.

(b) Information was collected from service cards giving number and size of meters, owner's name and address, and data as to meter setting with turn on and turn off data.

(c) Management was contacted to explain the historical background in connection with the purposes of the survey, the logic and reasons for cooperation in eliminating cross-connections on a uniform plan, the law backing up enforcement requirements, and an explanation of typical cross-connections and how they can be eliminated.

(d) Management was asked to provide proper passes to enter the premises and to appoint a water supervisor or other person to assist in the survey.



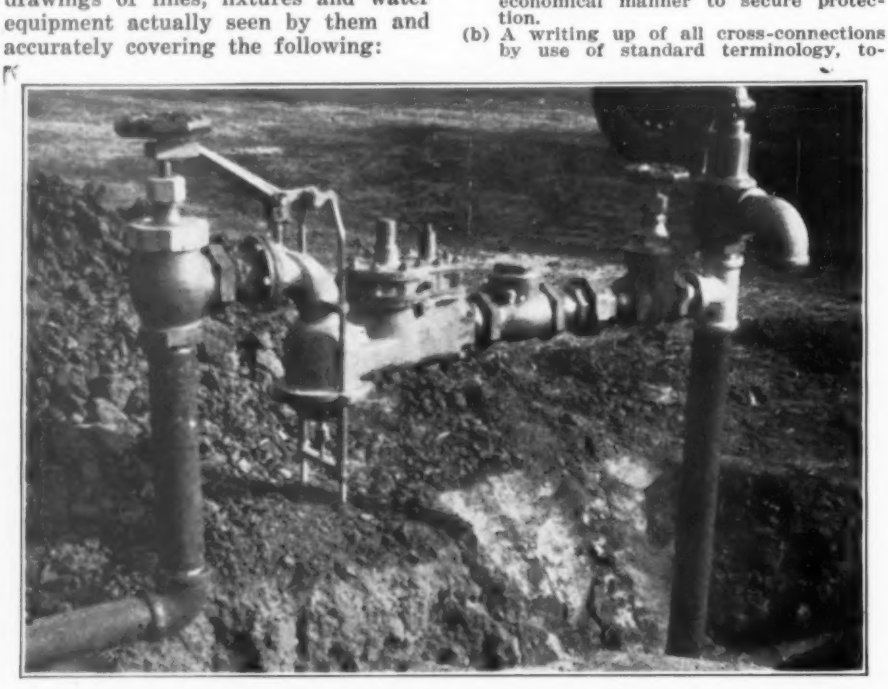
Backflow Preventer (Clayton type) on Domestic and Fire Services from Common 4-in. Inlet at Center (Vertical Line Entering from Back Between Two Gate Valves.)

(a) *Line to right contains check valve, vacuum breaker, check valve, pressure differential release and check valve.*

(b) *Line to left same sequence but vacuum breaker is on other side.*

2. In the field, inspectors prepared drawings of lines, fixtures and water equipment actually seen by them and accurately covering the following:

(a) City service connections.
(b) All city water, industrial, and process pipe lines.
(c) All plumbing fixtures as to type and size.
(d) All pumps and dual systems regardless of function, together with pressures and practices of operation.
(e) All water using equipment.
(f) All sewers and drains.



City Service (left) to Oil Lease (right) Showing 1938 E-C No. 3 Valve and Pressure Safety Valve (top right) in Addition to Relief Valve on Device.

3. Inspectors in the field made such water-use tests as to check on the accuracy of their maps and determined reasons and incentives for every cross-connection discovered.

4. Inspectors in many cases secured blueprints of water lines from management and used them only after careful verification. In many cases management requested copies of the inspector's drawings as being better than theirs so far as water piping plans were concerned.

5. Office work was carried on with equal assiduity covering such items as:

(a) A review of each cross-connection and a discussion as to the best and most economical manner to secure protection.
(b) A writing up of all cross-connections by use of standard terminology, together with remedies similarly expressed.
(c) Checking of all recommendations by office and field supervisors.
(d) Complete consideration of all legitimate city water uses which could possibly be anticipated so that there would be little danger in the future of new cross-connections being made.
(e) Issuance of recommendations in legal form setting forth instructions, laws violated, and enforcement agencies involved.

6. Proper serving of the recommendations to management is important and involves:

(a) Conferences with key personnel in which the program as a whole is again reviewed.
(b) Timing with recommendations of orders from Industrial Accident Commission, Naval and Army Security Officers, and interested agencies.
(c) Special efforts to explain any misunderstandings that field men at the plants may have in regard to specific recommendations.

7. Reinspections and contacts are necessary to follow up progress of the work and to lay foundation for subsequent regular inspection after completion.

8. All cross-connections must be eliminated before the file is closed.

As the program commenced in earnest, the Cross-Connection Control Advisory Committee approved of a 7-point program in cross-connection control which was endorsed by Army, Navy, and Public Health officials at a meeting on September 15, 1942, at the Naval Operating Base, Long Beach, California. Because this outline was carried through unchanged, it is repeated here as follows:

Seven Point Program

1. Backflow protection at meter of all services to premises fronting on the harbor and to adjacent industrial and commercial plants.
2. Backflow protection at the wharf for all ship supplies.
3. Segregation of domestic and fire lines as far as possible so that no unprotected cross-connections will endanger the domestic supply from pierhead, siamese, or salt water pump intakes.
4. Elimination of all dangerous plumbing inter-connections.

Summary of Cross-Connections Discovered
Jan. 1, 1942—Oct. 1, 1944

	Number	Total Number
1. Plumbing—55%		
Flush valves and flush urinals	3,504	
Low inlets	6,674	
Minor hazards	12,487	
		22,755
2. Equipment—26%		
Low inlets	8,015	
Steam, boiler	2,080	
Air, compressors, elevators	257	
Washington	364	
		10,716
3. Dual supplies—9%		
Salt water pumps	83	
Wells, oil wells	330	
Industrial, process and recirculation	1,846	
Pierhead connections	1,265	
Siamese connections	94	
		3,618
4. Sewer—5%		
Direct connections	1,747	
Ejectors, water-operated	174	
		1,921
5. Miscellaneous—5% (inter-street services, lawn sprinkling)		2,237
Total		41,247

5. Provision for the isolation of all pipe lines carrying processing water.
6. Adoption of color and sign scheme for designation of safe and unsafe water lines.
7. Organization of water foreman on each premises to carry out a unified plan.

Every conceivable type of cross-connection was discovered in this survey with such odd ones as cooling coils for X-ray tubes and direct connections to sewers through blood plasma equipment. The survey included 300 oil well properties. While the category of cross-connections was much longer than indicated in this report, the following summary is of value in pointing out the main dangers involved.

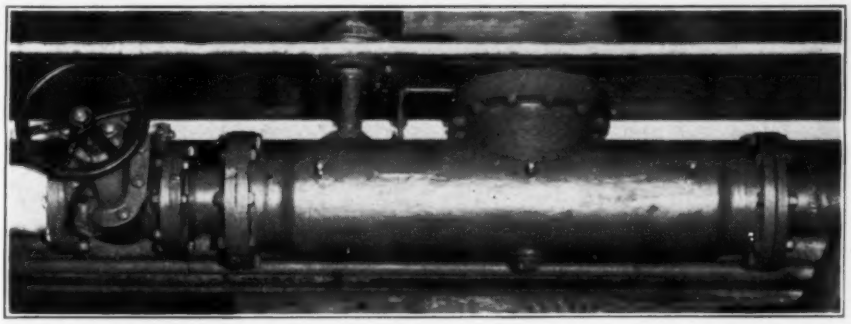
Results of this tabulation indicate that there are more direct connections to sewers through flush valves than through equipment. Accordingly, every city should wage vigorous programs in the correction of faulty plumbing. The majority of low inlets can be eliminated by mere raising, although in some cases vacuum breakers on the discharge side of valves are justified. The use of mechanical devices under pressure is largely outside the field of plumbing and involves protection against pumps for cooling, process and industrial waters as well as dual water and oil supplies. All direct connections to sewers should be physically broken.

A wide range of devices has been used to prevent backflow. The first group is vacuum breakers on the discharge side of water inlets to plumbing fixtures or submerged gravity inlets to tanks, requirements for which are covered by American Association Standards (A40.4—1942; A40.6—1943). The second type covers pressure-operated vacuum breakers and backflow protective devices which operate on pressure systems. The following tabulation indicates the magnitude of cross-connection elimination by use of devices:

Types of Back-Siphonage and Backflow Devices

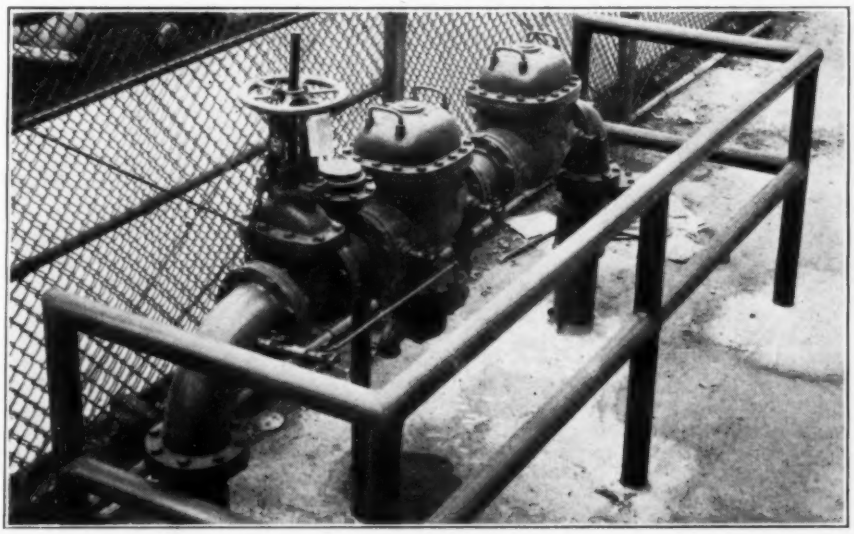
	Number
A. Plumbing type vacuum breakers	
1. Flush valves	4,000
2. Low inlets	10,000
Total	14,000
B. Pressure type backflow devices	
1. Vacuum breakers only	200
2. Backflow prevention	
Industrialized lines	1,232
Dual supplies	360
Meter protection	778
Total	2,570
C. Double check valves (150 with relief valves)	200
Grand Total	16,770

It is of interest to note the number of backflow prevention devices for different pipe sizes and that the most recent trend is to replace double check valves with complete devices, even for the larger sizes. The need for devices in sizes ¾-in. to 2-in. is apparent.



Industrializing 6-in. Shipyard Line with E-C No. 6 Under Wharf.
(Note vacuum breaker on left. Waste valve on pressure differential is on other side. Three test cocks are on side. Inlet side is on left.)

The cost to consumers for the entire program exceeded $2,000,000 with half of the work on the correction of plumbing fixtures, with about $500,000 involved in pressure backflow devices, and about $500,000 on pipe system changes to industrialize lines, parallel piping and breaking of sewer connections. Twenty-five contracts exceeded $25,000 and one contract reached $267,000.



6-in. Hersey No. 2 Double Check Valve Installation with Vacuum Breaker at Right of Gate, and Pressure Differential at Bottom Between the Two Checks.
(Fire service approved by local Board of Fire Underwriters' representatives)

Types of Backflow Protection Devices Giving Superior Protection

	E-C Valves	Clayton	Ellis	Double Checks* (Hersey)	Double Checks* (Rensselaer)	Double Checks* (Rebuilt)	Total
½"	128	3	18	—	—	—	149
¾"	406	52	46	—	—	—	504
1"	373	56	69	—	—	—	498
1½"	57	60	12	—	—	—	129
2"	272	155	23	—	—	—	450
2½"	29	101	—	—	—	—	130
3"	74	50	—	—	—	—	124
4"	18	105	—	4	—	20	147
6"	19	34	—	29	2	50	134
8"	—	8	—	20	27	36	91
10"	—	—	—	1	1	5	7
12"	—	1	—	3	—	3	6
Total	1376	625	168	57	30	114	2,370

*150 of these units have pressure differential relief valves.

Seth Van Loan Passes Suddenly

Chief Engineer of Philadelphia's Water Program

Seth M. Van Loan, long time connected with Philadelphia's Bureau of Water, passed away suddenly at his home last month, at the age of 72.

Since 1942 Mr. Van Loan had been Chief Engineer of the city's $18,000,000 water rehabilitation program. For seven years prior to that time he had been Chief of the City Water Bureau in which he started work in 1901 as an assistant engineer on design and construction of the Torresdale Filtration Plant.

Mr. Van Loan was a member of ASCE and AWWA. He had served the AWWA as a Trustee in 1928-30, and as a Director in 1933-36. He received the Fuller Award in 1943.

MAINE WATER ASSOCIATION HOLDS STREAMLINED MEETING

THE annual Portland meeting of the Maine Water Utilities Association which is usually the largest meeting of this organization during the year was this year of streamlined proportions due to the Washington edict prohibiting the holding of such meetings where transportation by sleeping cars or hotel room accommodations are required for more than 50 individuals.

To meet the requirements the customary evening session following a supper and entertainment provided by the Portland Water District was cancelled and the following notice was mailed to all members of the Association and others who ordinarily attended these meetings, requiring hotel accommodations. The notice explained the situation and closed with the statement:

"Consequently, the session scheduled for the evening of Feb. 13 has been cancelled and the conference scheduled for Feb. 14 must necessarily be limited to Superintendents, Managers and Engineers requiring no hotel accommodations in Portland."

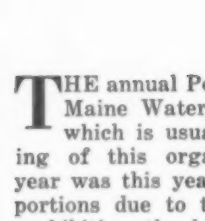
The notice stated that not more than 50 persons should attend in order to comply with the Washington directive. (We would point out that this constituted a mistake in interpreting the directive and rules laid down by the Wartime Convention Committee. The attendance is not being limited to any specified number, the limit of 50 being the number who will require hotel accommodations or travel by sleeping car.—Editor.)

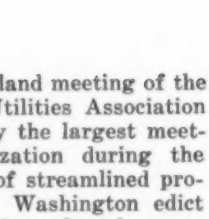
In any event the notice and the cancellation of the evening dinner session had its effect because the meeting on Feb. 14th with 105 present (a goodly number being local people) was just about half as well attended as ordinarily is the case. These 105 members and guests represented only 30 utilities.

Acting President*

Jo. W. Randlette
Supt.
Richmond, Me.

*(*For David E. Moulton, P.W.D. Attorney)*





Programmers

*Fred J. Reny**
Gen'l Mgr.

J. Arthur Jackson
Asst. Treas.

Portland Water District
Portland, Me.

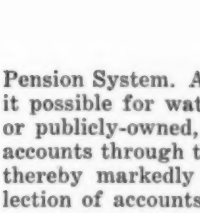
*(*Recently honored on 40th anniversary with Portland's Water Utility)*

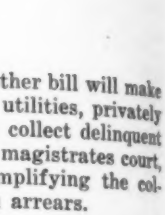
February 14th Program

The forenoon was devoted to shop-chatter by those arriving early. Then followed two movies—one being titled "A Tornado in a Box," which was the educational film of Allis Chalmers which explains the workings and design features of the gas-turbine, which offers great possibilities as the prime-mover of the future. These films were run off by Maurice Libby, sup't. at Bath, Me., and the Association's official "Keeper of the Lantern."

After the dinner, served by a group of ladies from one of the Portland churches, the afternoon session, presided over by Vice President Randlett, got under way with a report from the Legislative Committee by **Geo. F. Giddings**, Treasurer, Augusta Water District and for 42 years connected with the Public Service Commission of Maine until his recent retirement. Mr. Giddings reported on a bill which will permit publicly-owned water utility employees to participate in the State Pension System. Another bill will make it possible for water utilities, privately or publicly-owned, to collect delinquent accounts through the magistrates court, thereby markedly simplifying the collection of accounts in arrears.

J. Elliot Hale, Acting Director of Sanitary Engineering, State Department of Health, reported that a completely new Stream Pollution bill is now being made ready for legislative action and another bill is designed to give the Maine Public Util. Assn. power to issue permits to blast ice jams, log jams or other obstructions to stream flow.

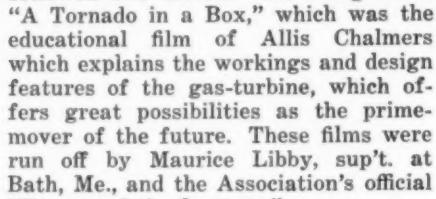




Committee Chairmen

Geo. F. Giddings
Treasurer
Augusta Water Distr.
Augusta, Me.

J. Elliott Hale
Actg. Chief Engr.
State Dept. Health
Augusta, Me.



Hosts

Everett O. Boothby, Asst. Supt.
Harry U. Fuller, Chief Engr.
Chesley L. Ward, Supt. Meters

Portland Water District

Moulton on Water Utility Law

President Moulton, Atty. for the Portland Water District, was slated to present the sixth installment of his valuable compendium on Water Utility Law, constituting a reference series of papers on this important topic. Attorney Moulton being in Florida, his discussion of the question of **"Discrimination"** in utility operation was ably presented by **Fred J. Reny**, Gen'l Mgr. of the Portland Water District. First discussed was the important rule of "equality of treatment and equality of service to all" as a protection against suits claiming "discrimination" by the utility management. He pointed out, however, that variation in the base of water rates is acceptable to the courts, provided such variation can be justified on the basis of actual cost of delivering the water in each case. For instance, higher rates have been considered permissible to outlying or suburban districts, where booster pumping is required, where some extra form of service is involved, etc. As to rates, a utility is guilty of discrimination if it

gives preferential rates to a stockholder. Likewise, any preferential rates offered to attract a new industry is plainly discrimination. On the other hand a water utility can give lower rates to one community than to another if costs of providing service is lower in one than in another.

Concerning the practice of serving more than one customer through a single meter: it has been held by courts to constitute discrimination but higher than all year rates to summer or winter resorts, camps, etc., is not discriminatory, since the customer demands on and off service while the utility has a continuous investment required to be "ready to serve" at all times.

(Ed. Note: Mr. Moulton, as long time attorney for the Portland Water District serving a number of communities, has had exceptionally varied experience in "Water Utility Law." His series of papers, therefore, will constitute a compendium of exceptional value, both from the standpoint of references to court findings and decisions in representative cases, and for his own opinions and warnings as a seasoned water utility attorney and counselor. It is hoped that Mr. Moulton's "Water Utility Law" will become generally available to the water works profession at large, preferably as a separately bound reference volume.)

Selection, Setting and Maintenance of Large Meters

The policies and practice in the selection, setting, and maintenance of meters on large services in the Portland Water District were described by **J. Arthur Jackson**, Asst. Treasurer of the District.

Mr. Jackson explained that the removal of large meters for test and maintenance without disrupting service to the customer had constituted a problem which had been solved by replacing large single meters with smaller meters set in parallel in battery meter installations. Not alone had the multiple meter installations solved the problem of maintenance by making it possible to remove meters one at a time for testing and maintenance, in addition the revenue per commercial customer had increased as the result of the battery installation registering flows which the larger compound meters had not registered with the same accuracy or completeness.

In determining the number of the smaller meters to install in place of the larger meter a careful study and observation is made of the peak demand flow, the average and minimum. Interestingly, the several battery meters do not all register equally. This indicates that the minor flows are being more accurately registered by passing largely through the meter imposing the least resistance—or more likely it is the check valve and fittings which exhibit the lower resistance. In either event, as Mr. Jackson pointed out, the battery exhibits a "firing order" with one after another cutting in and out as the flow rate increases and then reduces.

Mr. Jackson, with large sketches, then described in some detail representative battery installations. One was a large hotel now served by four 2" meters in place of a single 6" compound. Another hotel with a 4" meter now is adequately served through a pair of 2" meters. A large paper mill is now served through a pair of 8" compound meters replacing a 12" Detector meter. In every case the battery was designed to fit into the thin existing meter vault by following precision adaptation of fittings for the 2" meters, or providing "specials" in one or two instances in connection with the larger units.

"Wheel-Horses."

Sid. S. Anthony
Supt.
Augusta Water Distr.
(M.W.U.A. Jour. Editor)

Maurice A. Libby
Supt.
Bath Water Distr.
("Keeper of the Lantern")

In comparing costs, Mr. Jackson pointed out that whereas one 4" meter costs $290, the cost of two 2" meters is only $150. Therefore even three 2" meters will cost less than the single 4" meter. However, the P.W.D. felt that the real interest lay in the advantageous flexibility of the installation, the greater ease of maintenance, and increased revenue, rather than any saving in first cost. Should the customer's peak demands increase nothing could be much simpler than the addition of another unit to the battery.

Mr. Jackson closed with the statement that the best methods of employing battery meters had probably not been found yet, and suggested the problem to technicians as one for study, looking to perfection of schemes for application under individual circumstances.

"Billing Methods of the Portland Water District" were then described by J. C. Jones of the Billing and Accounting Dept., who said that there were 250 commercial and industrial meter accounts, many with battery installations. Accounting is carried on through the customer ledger method. Each meter of a battery has its individual ledger card. These are then totalled on a master card revealing only the composite or total reading.

In the discussion which ensued it was noted by L. H. Enslow that C. M. McCord, Supt. of Memphis, Tenn., had made a rather complete study of several methods of large customer metering, and he, too, had ample reasons to favor battery metering. Amongst other things Mr. McCord had purposely placed lead disc weights on the flaps of the checks of all meters in the battery save one or possibly two. In any event this was done to create obstruction to the minor flows, causing all such to travel the path of least resistance and that meant through the one meter without the weighted check. The scheme was a success in raising the total registration by the battery. In other words Mr. Jackson's "firing order" of battery meters can be artificially arranged to insure that any selected unit will be the first to "fire" and the last to "cease firing."

Shop-Chatter

A. F. "Andy" Murphy, Boston
Revere Copper & Brass

"Sid." Anthony, Supt.
Augusta Water Distr.

"Jo." G. Lufkin (from rear)
Red Hed Mfg. Co., Boston

Maurice H. Burr, Supt.
N. E. Harbor Water Co.

J. M. Littlefield, Clerk
Auburn Water Distr.

Allan F. McAlary, Supt.
Rockland & Camden Water Co.

"Reggie" Hayes, New York
"Hydrotite's" Sales Mgr.

R. E. "Bob" Fergusson
Hersey Meters, Boston

Edwin T. McDowell, Supt.
Biddeford & Saco Water Co.

*(*Spry 77-year young dean of New England's "Ambassadors of Commerce," has sold to Water Works men for nearly 60 years)*

Walter C. Winn, Board Chairman
Water Distr. of Lisbon, Me.

Robt. E. Fergusson, Sales Engineer
Hersey Meter & Mfg. Co., Boston

A. F. Goldsmith, Supt. and Commissioner
Water Dept. of South Paris, Me.

A Leak That Started a Water Business

Around Freeland, Michigan, it was difficult to get a good supply of fresh, palatable water due to the prevalence of salt and sulphur in the water sources of the district.

Years ago, James F. Graham, former state representative from Freeland, had a private well dug but the supply dwindled. Then, he had a deep well drilled.

During the pumping test, water seeped in to a neighbor's basement. "If Jim has so much good water to waste," thought the neighbor, "maybe he can supply some to me."

Jim Graham agreed to do so and the story got around. More neighbors wanted to "hook on" and it was decided to hold a meeting at the local bank. So many people wanted "in" on the proposition that Jim Graham had a network of pipes installed to serve his neighbors.

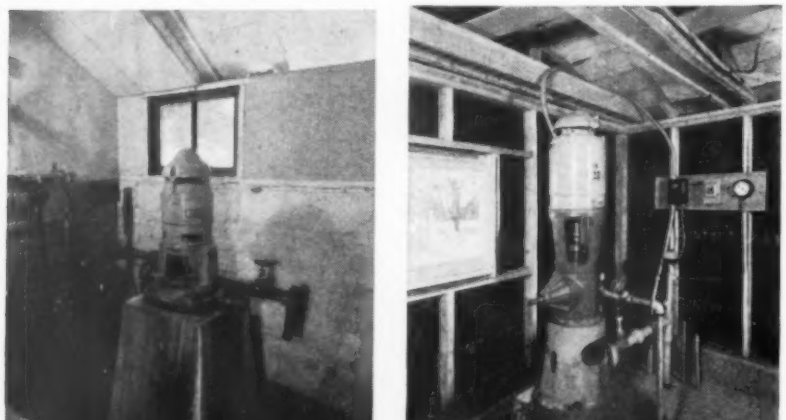
The original pump having failed on the job a nationally known pump was installed. It gave service for many years and was "retired" when the increasing demands called for a new pump of larger capacity.

A larger capacity deep well pump known as the Deming "Minuturb" was installed, but even a 'round-the-clock schedule did not keep up with the increasing demands, so Jim Graham, who has several other interests besides his "water business," had a teammate installed in a second well. It was wisely fitted with an auxiliary drive to serve in case of power failure.

The combination of the two pumps has proved adequate to meet the water needs of approximately 350 families which represents practically the entire town of Freeland. The average pumpage is 100,000 gallons per day.

The charge for service is $2.00 per month per customer, but if more than 3,000 gallons per month are used, the water is metered and the charge is 50c per 1,000 gallons in excess of 3,000 up to a total of 7,000 gallons per month. Any excess over 7,000 gallons is paid for at the rate of 25c per 1,000 gallons.

His "water business" continues to grow, and Jim Graham's present plans call for drilling another well on the other side of Freeland. And that's the story of how a "leak" started a profitable water business.



The Two Deming "Minuturb" Pumps of the Jim Graham Water Co. that Started Because of a Leak

More Blue Print Now in Action

At the end of last August, the Committee on Water and Sewage Works Development reported that out of all public works planning, on the drawing boards or completed, water works made up 6.5 per cent and sewage works 11 per cent of the total. This appeared to be a healthy sign in view of the fact that over the last twenty years water works construction has made up 2.6 per cent of the total and sewage works, including disposal systems, have made up 4 per cent.

On February 1, 1945, according to Mark B. Owen, Director of the ASCE Committee on Post-War Construction, water works projects totaled $401,373,000 and sewage works projects totaled $812,608,000.

Out of a proposed public construction of nearly six billion dollars, these water works projects are equivalent to slightly over 7.0 per cent, and sewerage works to 14.2 per cent of the total. This trend over the situation in August would seem to be a healthy sign, although most of these proposed expenditures appear to be in only twenty states.

Author Corrects Cathodic Protection Formula

Mr. L. P. Sudrabin, author of the series of articles on Cathodic Protection appearing in *Water Works and Sewerage*, has written us recently suggesting that an author's correction be made in a formula in the first of the series of articles published in the January, 1945 issue.

The incorrect formula, which appeared on page 16, illustrates the effect of the ratio of the cylinder diameter to the electrode diameter upon the resistance of a concentrically positioned electrode in a cylinder. This formula should read as follows.

$$\text{Resistance} = \frac{2.303r}{2\pi} \log_{10} \frac{R_2}{R_1}$$

where

r = specific resistance
R_2 = cylinder diameter
R_1 = electrode diameter

Water Works Courses in Michigan

Inservice Training School in May

Following the efforts of a committee on education of the Michigan Conference on Water Purification, it has been announced that extension courses were held in February at five places.

Bacteriology was offered by W. L. Mallmann at Lansing; chemistry by G. M. Ridenour at Battle Creek; hydraulics by E. F. Brater at Detroit; chemistry by G. M. Ridenour at Ann Arbor, and biology by F. E. Eggleton at Grand Rapids.

John M. Hepler, Director of the Bureau of Engineering, of the Michigan Dept. of Health, also has announced that an Inservice Training Course will be held at the Ann Arbor School of Public Health on May 22, 23 and 24. Pre-registration is required before May 1. The course fee is $5 for the 3-day school. Subjects will include Chlorine (1 day), Iron (1 day), Fluorine (½ day), and a half-day discussion period at the close of the meeting.

Lecturers on chlorine include H. H. Willard, H. A. Faber, N. S. Chamberlain, G. P. Vincent, and R. D. Bates. A. M. Buswell, R. L. Starkey and A. H. Weiters, will lecture on Iron, while Dr. Trendley Dean, F. J. McClure, Dr. Phillip Jay, and W. Leslie Harris will lecture on Fluorine.

The course is designed for and conducted especially for water plant operators, but other persons interested in the subject material are welcome to attend.

Address all inquiries to Prof. Harry E. Miller, School of Public Health, University of Michigan, Ann Arbor, Mich., who will arrange dormitory facilities for those who request such along with their application for admission to the course, and post the registration fee of $5.00.

PRE-STRESSED "GUNITE"

Successfully Employed in Construction of Twin Balancing Reservoirs for Schuylkill Haven, Pa.

By I. M. GLACE
Consulting Engineer
HARRISBURG, PA.

AS HAS been the case with many other municipalities, the establishment of a vital war-industry in the territory served by the Gas and Water Department of the borough of Schuylkill Haven, Pa., necessitated a considerable expansion of the water supply system. Certain features of the project to be described are believed to be somewhat unique and of general interest to the water works profession. Although the quantities of water involved in the Schuylkill Haven project are not great, when compared with total demands of other war-plant areas, the relative quantities of water required placed an extraordinary demand on a typical Pennsylvania community, resulting in an increased load approximating 400 per cent of the pre-war average daily consumption.

The unusual or most interesting features of the project were:

First, the construction of pre-stressed gunite balancing reservoirs, probably the first of this type installed in Pennsylvania for a public supply.

Second, the value of balancing reservoirs in augmenting the capacity of pipelines, and in equalizing pressures.

Third, at least from the writer's viewpoint—the comparative ease of a straight municipal contract, without the red-tape and restrictions of forced cooperation with U. S. government representatives, peculiar to subsidized construction projects in recent years.

The borough of Schuylkill Haven has a population of about 6000; a contiguous borough, Cressona, about 3000. These communities and some adjacent areas are served with water by the Gas and Water Department of Schuylkill Haven borough. Prior to the war the average daily consumption of the area was less than 500,000 gpd. At its recent peak, some months ago, the daily demand was just above 2,000,000 gpd. This increase was due to the augmented demand of the many small industries in the area, mostly knitting and dyeing plants, but principally to the daily use of about 1,300,000 gallons by a war industry. The low average daily pre-war consumption of 55 to 60 gals./capita was due to 100 per cent metering of services, and persistent efforts to keep down the loss through leakage. All water is taken from the sand-stone formations of the practically uninhabited mountain north of the borough, with chlorination as the only routine treatment process.

The Author

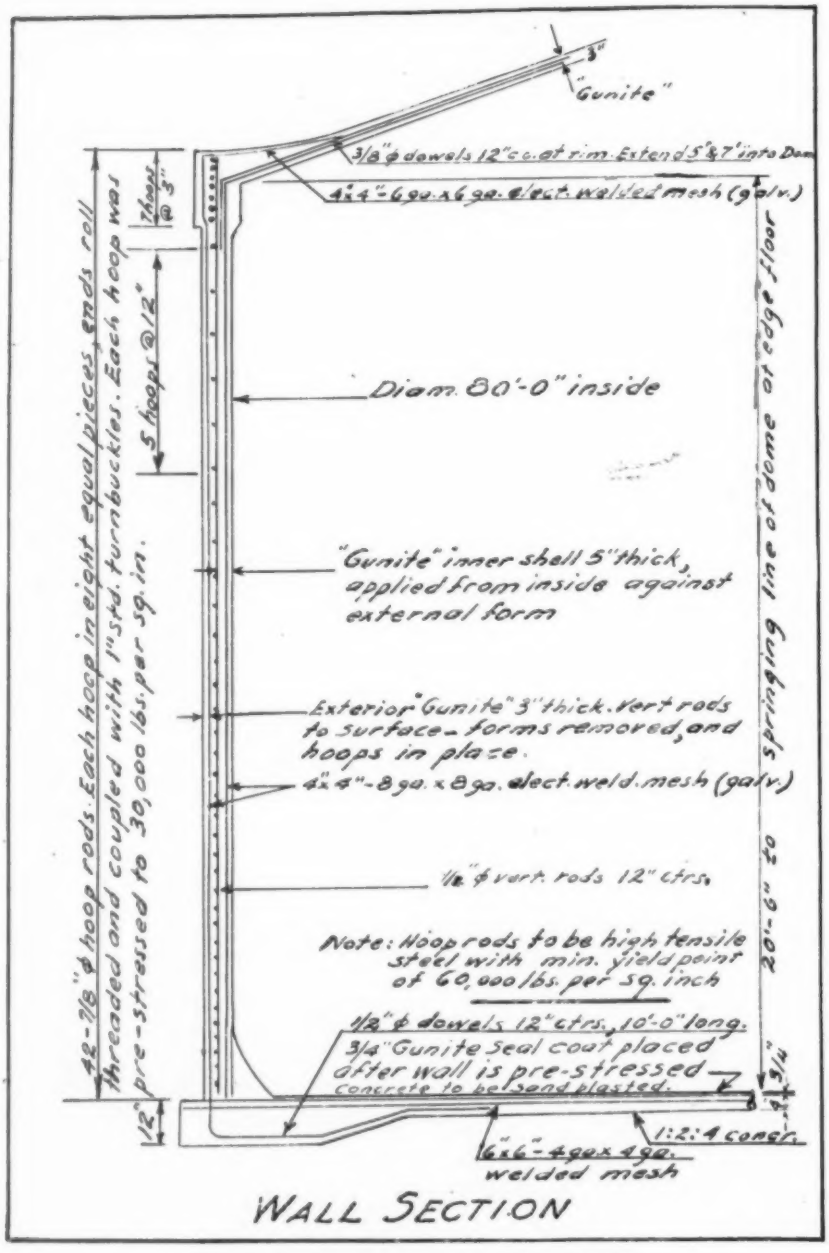
Speed Proved Vital

Construction of this war plant was done by a manufacturing company acting for and in behalf of the Defense Plant Corporation, and was begun early in 1942. Investigations on possible sources of water supply, negotiations, and numerous conferences delayed the installation of the necessary water supply for the war-plant—first estimated to require about 4 million gallons a day—until April, 1943, when it was finally agreed that service would be supplied by the Schuylkill Haven Gas and Water Department. The industry went into partial operation in the following month, many weeks before such operation was anticipated by the Water Department, and certainly before the Department was fully prepared to handle the increased load. Speed in completing the Department's necessary enlarged facilities became, therefore, an unusually vital matter.

Supply mains entering the community are 12 in. and 8 in. in diameter, from separate and distinct sources. The Department claimed that by the installation of balancing reservoirs to permit these lines to be used at their full capacity, over each entire 24-hour period, the mains would be ample in capacity to meet all the increased demands on the system, including momentary peak demands, and thus save the cost of construction, critical materials, labor and time required for an alternate project involving the construction of approximately four miles of 14-in. main through very rugged terrain. At the same time there would be insured continuously better service, and less hazard to interruptions in service to the war industry. From this standpoint, as well as all others, the project as completed has been entirely successful.

Twin Balancing Reservoirs of Schuylkill Haven, Pa.
(Thin Wall Construction of Prestressed "Gunite" Concrete)

The Cement Guns at Work—Outside and In.


3"
"Gunite"
3/8"ϕ dowels 12" c.c. at rim. Extend 5'-7" into Dam
4"x4"-6 ga. x 6 ga. elect. welded mesh (galv.)
Diam. 80'-0" inside
"Gunite" inner shell 5" thick, applied from inside against external form
Exterior "Gunite" 3" thick. Vert. rods to surface - forms removed, and hoops in place.
4"x4"-8 ga. x 8 ga. elect. weld. mesh (galv.)
1/2" ϕ vert. rods 12" ctrs.
Note: Hoop rods to be high tensile steel with min. yield point of 60,000 lbs. per sq. inch
1/2" ϕ dowels 12" ctrs. 10'-0" long.
3/4" Gunite seal coat placed after wall is pre-stressed
concrete to be sand blasted.
1:2:4 concr.
6"x6"-4 ga x 4 ga. welded mesh
WALL SECTION

Details of Wall Section of 80' diam. Tanks.

As was said before, speed was vital. The writer, as consultant to the borough, had made investigations prior to the agreement with the Defense Plant Corporation for service, and was convinced that the type of reservoir as developed and constructed by the Cement-Gun Co., holders of the original patents on the cement gun, could be constructed in less time than standard heavy-wall, reinforced concrete structures. Also, these were somewhat less expensive to construct than more standard structures in the size required, and were less subject to initial leakage. The use of pre-stressing hoops likewise seemed to offer advantages for circular gunite reservoirs. Since the reservoirs were planned to be permanent parts of the supply system, and were so located, permanence was also a requirement. Steel storage basins were unobtainable at the time of construction, although at the time restrictions on the use of reinforcing steel had been eased off somewhat by the War Production Board.

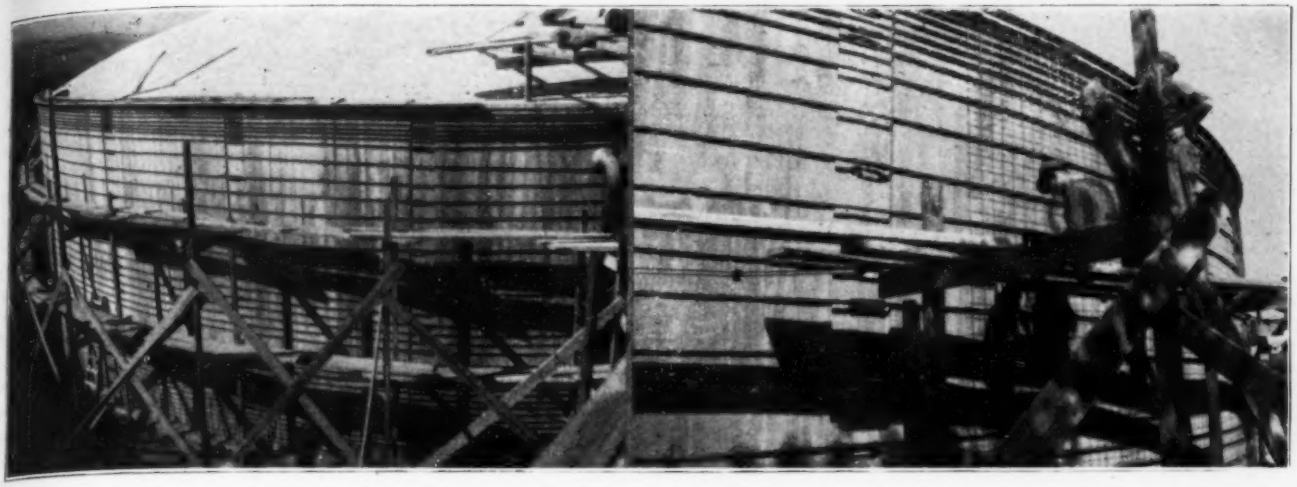
Twin Balancing Ground Tanks

Twin balancing reservoirs were selected for flexibility in operation, and for increased speed in construction. The tanks as constructed are each 80 feet in diameter, with an effective depth of 20 feet, and a capacity each of 750,000 gallons. Manifold connections were installed, with two separate outlets, the lower of which supplies the industry through its own 14-in. main, and the upper, located at two-thirds of the depth of the tank, supplies the Department system. This feature of the outlet mains permits the reservation of some 500,000 gallons of water for the industry alone, after the water in the upper portions is depleted. This of course was done for protection of the war plant against any interruption in service.

"Gunite" is the trade name for a mixture of cement and sand, without coarse aggregates, which is applied at relatively high pressures against a surface—not in forms—and with a water content just sufficient to insure proper hydration. The pressure application results in the natural rejection of excess materials. Sand and cement ratios are controlled automatically, through hoppers and by means of a screw drive, and delivered to an air-pressure tank, the "cement-gun," from which the mixed sand and cement is carried through hose lines to the nozzle, where it is mixed with water and applied.

The resulting concrete has a density considerably greater than that of poured concrete. When applied to clean surfaces, the adhesion value is greater than the strength of the original concrete. One of the claims of the contractors, that "bottle-tight" reservoirs can be constructed with "Gunite," seems to have been substantiated on this project.

Details of the bottom slabs and wall sections, as constructed, are shown in the attached drawings and photographs, showing the absence of any columns or



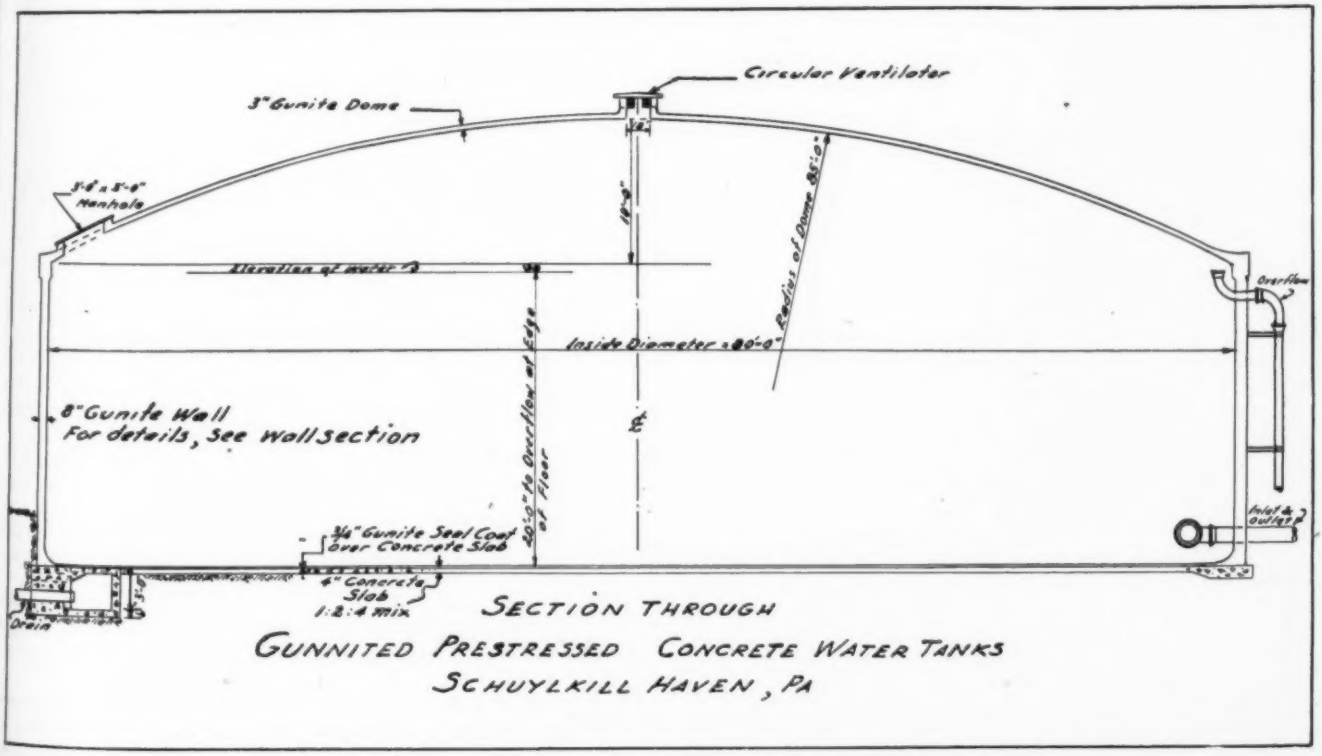
Exterior of Prestressed 5" Wall "Gunite" Tanks, Ready for Water Before Applying the Protective "Gunite" Exterior Jacket Over the Hoops.

(Note the spacing of the prestressing hoops and the turnbuckles which turn in their respective niches.)

joints in the floor slab. In the construction of these units the floor slab is first poured. Then a single timber form is erected and gunite concrete is shot against the form in successive layers of about 1½-in. each, until a wall of 5 in. in thickness has been produced. This wall is allowed to set. Hoop rods are then placed around the structure, stressed by means of turnbuckles and weighted lever wrenches to a pre-determined point, and finally protected by additional layers of gunite applied to the exterior to a depth of 3 inches. The final processes include the construction of timber work and roof forms for the application of the thin-shelled and domed roof, and the shooting of a one inch seal coat of gunite over the poured floor-slab.

As said before, production of materials at the war plant began some time ahead of anticipated schedules. The tremendous variations in flow at the war-plant, fluctuating many times daily between 300 and 2000 gpm. with literally instantaneous changes in rates, were working havoc in the distribution system of the Department and the necessity for some balancing volume became imperative. By consent of the contractors, water was introduced into the reservoirs immediately on completion of the first 5-in. wall and after the setting and stressing of the hoop-rods, and for several weeks the water depth in the reservoirs was carried at its full depth of 20 feet, with only this thin 5-in. wall as the retainer.

This immediately relieved the pressure load, and also permitted 24-hour continuous use of the 12-in. supply main at its full capacity. Uniform pressures throughout the entire distribution system became possible, ending



Section Through the 80′ diam. Tanks with Unsupported Reinforced "Gunite" Domes

"Shooting" a Dome at Schuylkill Haven.

immediately all disturbances in flows in the system.

A Watertight Job

With only the 5-in. wall in place, under a head of 20 feet of water and before a seal-coat had been placed over the floor-slab, no appreciable leakage occurred in the tanks. Several wet spots became visible on the wall sections—completely exposed and thus subject to inspection—but the volume of this visible leakage could have been figured in gills, rather than gallons. No drop in water levels was apparent under tests which were convincing. Since the completion of the tanks, no precise tests on leakage have been made, because of the necessity for maintaining the reservoirs in constant service. Such leakage, if occurring, could be only through the bottom slab, since the exposed walls were open to inspection for several months after completion and before backfilling was begun.

These tanks have now passed through a severe winter and summer. One tank shows hair-line cracks in the exposed outer walls, due probably to too rapid drying of the concrete, but no spalling has occurred and no leaks are apparent.

Costs

The reservoirs were constructed by the Cement Gun Co., of Allentown, Pa., as low bidders under advertised bidding. The cost was $48,890, which included excavation and backfill, but not the piping connections, valve chamber, and other appurtenances, which were installed by the water department with its own labor forces, at an additional cost of about $5000. No extras were required by the contractor on the project.

The value of these balancing reservoirs on pressures and volumes have been well demonstrated by charted pressure and flow records. Momentary combined peak loads of the war-plant and the borough have been measured and estimated to be 3000 gallons per minute, whereas the momentary capacity of the 12-in. main, as the principal source, is only about one half of this demand. Therefore, the balancing reservoirs, serving as relief for these momentary demands, have practically doubled the capacity value of the existing main, and at the same time have permitted the maintenance of pressures not varying over 2 or 3 pounds under maximum loads. Of course, adequately sized distribution mains, serving the borough and war plant through separate connections, helped considerably in maintaining these uniform tap pressures.

Emphasis was made above on the ease of construction, despite the haste, and the non-payment of "extras." In recent years, under PWA and WPA, and more lately on war contracts under government subsidization, the engineer and the contractor have been subjected to a multiplicity of red-tape, conferences, changes in plans, and compromises in design, which have caused endless administration headaches in the last few years. All this was escaped under the municipal contract without friction; and, it is believed, at a considerable saving in total costs to the Water Department. The experience of working in a community which stands on its own feet, spends its own money, and refuses subsidies, has been delightful. It is to be hoped that more American communities adopt the same method for the post-war construction projects now being planned.

The active superintendent of the Schuylkill Haven Gas and Water Department is Mr. John Edling. The chairman of the water committee under whose control the work was performed is Mr. Jere Harner. All of the work was done under the writer's supervision. In the detailed design of the tanks, the engineers of the Cement Gun Co. cooperated.

Cross Connections and Back Siphonage

National Research Council's Sanitary Engineering Report No. 8

The Temporary Sub-Committee on Cross Connections of the Committee on Sanitary Engineering of the National Research Council has made a report on Cross Connections and Back Siphonage Connections Under War Conditions.

After analyzing the types of cross connections, the peacetime problem, changed conditions, etc., the committee gives five methods of prevention of backflow into potable water systems. In brief these are as follows:

1. Physical separation with a safe air gap.
2. Use of a vacuum breaker.
3. Use of a backflow preventer which operates under pressure and has a central zone between check valves and with relief to the air, where the pressure is less than that of the potable supply.
4. Use of double check valves on 6-inch or larger lines.
5. Use of single check valves on 2-inch lines or larger.

The conclusions and recommendations of the committee are briefly:

1. The ultimate but impossible ideal is to have no need for auxiliary supplies. The possibility of back-siphonage with plumbing systems, process water, and sewer systems does exist.

2. Personnel assigned to operating water supply connections and equipment should have adequate instruction and supervision at all times.

3. If connections with plumbing systems cannot be eliminated, they should be provided with approved type vacuum breakers.

4. Process waters should be separated from potable supplies by Method 1, or as a temporary measure by Methods 2 or 3 above.

5. Every direct connection between potable supplies and sewers should be broken by air gap separation.

6. Where lines for both potable and non-potable supplies exist, each should be painted a distinctive color to indicate which is which and outlets of non-potable supplies should be so labeled.

7. Federal agencies should institute a survey of water service and distribution pipe adequacies at pier heads.

8. During the war, shore users near pier head connection should be protected by Methods 3 or 4.

9. Backflow preventive devices should be installed at each shipside outlet, whether domestic or fire service.

10. All cross connections between potable and non-potable water supply lines on vessels should be broken and so maintained.

11. The use of double check valves as described in Method 4 is inferior as a substitute for Method 3, even on 6-inch lines or larger.

FEBRUARY N.E.W.W.A. MEETING

By HARRY A. FABER*
Editorial Associate

THE busy monthly meeting of the New England Water Works Association in Boston on February 15th required less than six hours and was held in full compliance with rulings of the O.D.T. regarding conventions. The program presented, however, indicated that such local meetings can be highly informative and can fully justify attendance of all members within reasonable distances, which do not require travel by sleeping car or hotel rooms for more than the permissive 50 persons.

For those arriving by ten in the morning, a one-hour "Water Works School" provided a review of "Fundamental Relations in Fluid Flow" by Prof. George E. Russell, Massachusetts Institute of Technology. This lecture constituting one of a valuable series being given by Prof. Russell was primarily an introduction to succeeding lectures which the same speaker will deliver at future sessions of the "Water Works School" preceding each meeting.

At eleven o'clock, members could choose to attend either of two Round Table sessions—that for superintendents or that for chemists.

The luncheon, at one o'clock, also provided an opportunity to renew acquaintances and to talk with friends. Then, following an excellent Red Cross motion picture and an appeal for contributions to the 1945 Red Cross Fund, two technical papers were presented. By four o'clock in the afternoon the meeting was adjourned and members were again headed back home to their jobs of producing a vital material for the war effort—even more capably than before.

Round-Table Chairmen

Walter C. Conroy
Gen'l Sup't.
Water & Sewerage
Belmont, Mass.

Harry A. Faber
Research Chemist
Chlorine Inst.
New York

Superintendents' Round Table

Chairman: Walter C. Conroy, General Superintendent Water Department, Belmont, Mass.

President Pro-tem

H. W. Griswold, Vice-Pres., Hartford, Conn.

(Presided in absence of Pres. Kennison, at home sick.)

Topic: **"Financing Main Extensions in New Developments."**

Mr. Conroy opened the session with a review of experiences in financing extensions into new real-estate developments at Belmont, Mass.

Belmont is one of the communities situated very close to Boston which experienced a very considerable building boom following the previous World War. In 1909, Belmont's population was 5,305; in 1926 it was 16,400; and in 1944 it was 28,600.

Up until 1927, Belmont carried on its main pipe extensions under the guaranty form of arrangement, and the real estate developer was required to guarantee to the town a revenue of not less than six per cent per annum on the money invested in the extension.

In 1927, an extension of a water main to one or two individuals was on the basis of a guarantee of a sum to equal 10% of the cost of the extension.

Then in cases of subdivisions of lands for development, the promoters were required to pay the town a sum in advance equivalent to 75% of the estimated cost of laying the main pipes in the new streets, of pipes six inches in diameter, and the town assumed the additional costs of larger pipes if the Water Commission considered it advisable to lay pipes larger than six-inch.

This arrangement has worked out very satisfactorily and the town has collected $91,000 from real estate developers towards the costs of financing main extensions.

Mr. Conroy stated this method is a form of advance assessment, which while it may be viewed as somewhat costly to the developer in the early stages of the development of his land, it enables him to allocate the cost of the water distribution system in his development to the several lots of land comprising such. By this method a purchaser is assured water service when he purchases his land.

The open discussion brought out many interesting methods of financing extensions. Wellesley assesses 100% of cost to the promoter. Supt. Leland Carlton of Springfield, Mass., reported that the promoter is required to deposit $20 per 100 ft. of extension, with a credit of the revenue received for water sold applied to each lot. Supt. Roger Oakman of Needham, Mass., makes extensions in his town on a guarantee basis of 6% on cost of completed job.

Supt. Wm. P. Melley of Milton, Mass., has been requiring the applicant of an extension to pay 33% of the costs. However, Milton now has pending a change which will require the applicant to pay 100% of the cost of the extension. Supt. Sydney C. Bean reported that Weymouth requires that the promoter pay the entire costs.

Fred J. Reny, General Manager of the Portland Water District, stated that 40 years ago, Portland worked on a 10% guarantee basis. They now charge the entire costs to the developer, based on the minimum size of pipe required for the service demanded.

Charging the entire costs to the developer, and he dividing the costs on a per lot basis, is a small per cent of the value of the lot, where lots are valued from $1,500 to $4,000, but the percentage is much greater on lots that only have a value of $300 to $1,000. In the high valued areas this is absorbed very easily and is not very noticeable, but in communities where the land values are lower, it does make a substantial difference in the price of the lot. In some small towns the entire costs of extensions are, therefore, charged into the tax rate.

Officers

Arthur L. Shaw
Metcalf & Eddy
Engrs.
Boston
(Acting Sec'y.)*

Joseph C. Knox
State Dep't. Health
Boston
(Program Chm'n.)

**Handling the job for Sec'y. Gifford, recuperating from a heart attack.*

*Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

It was the consensus of opinion that this was a very timely subject as it bears an important relation to post-war planning, particularly to communities that still have a great deal of undeveloped land and which are likely to experience a considerable building boom soon after the War is ended.

(For the above report covering the Superintendents' Session we are indebted to Roger W. Esty, sup't. at Danvers, Mass.—Editor.)

Chemists' Round Table

Chairman: Harry A. Faber, Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

Programmers

Warren J. Scott
Chief Engineer
State Dep't. Health
Hartford, Conn.

David C. Wiggin
Ass't. Engr.
State Dept. Health
Hartford, Conn.

Topic: **"A Critical Review of Residual Chlorine Tests."**

This review was principally devoted to the ortho-tolidine test because this method has proven to be of greatest simplicity, of sufficient accuracy, and is most widely used. While ortho-tolidine was proposed for the determination of residual chlorine by Phelps in 1913 and the method was standardized by Ellms and Hauser in the same year, it was not until about 1917 that its practical application in the control of water chlorination was developed and popularized by the studies of Enslow and Wolman which date back to 1915 in Maryland.

The simplicity of the test has contributed greatly to improved control of disinfection and, consequently, to the safety of public water supplies. In its application, this test has certain limitations in that interfering substances (manganese, nitrites, and iron) are sometimes present in amounts sufficient to produce colors similar to those produced by chlorine. In addition, it does not enable free available chlorine (highly active) to be differentiated from combined chlorine (a slower disinfectant). Many attempts have been made in the past to modify the technic of the ortho-tolidine test to control these limitations, but never with complete success. Several of these were described.

A recent refinement of this test has been developed by Gilcreas and Hallinan of the New York State Department of Health. Their OTA test (ortho-tolidine-arsenite) employs only one additional reagent, sodium arsenite, and in a simple manner enables the amounts of free available chlorine, combined chlorine, and interfering substances to be separately determined in a sample of chlorinated water. Mr. Faber demonstrated the procedure in making such a test with equipment as now provided for the OT test.

Laboratory studies and practical experience have shown that only free available chlorine residuals, which develop full color with OT almost spontaneously, assure rapid disinfection. However, with long contact times, a residual composed of both free available chlorine and combined chlorine may be entirely adequate. The results of disinfection must always be determined by bacteriological examinations, but the OTA test enables more dependable control than has hitherto been possible. Thus, it may be considered that the ortho-tolidine test is more firmly established than ever before and will continue to be one of the most important tools in water purification.

"Recent Survey of Interior Water Piping in Connecticut," by David C. Wiggin, Jr., Sanitary Engineer, State Dept. Health, Hartford, Conn.

Mr. Wiggin described the survey of interior water piping in the larger cities and towns of Connecticut which the State Department of Health began in 1937 in order to detect those piping connections providing potential hazards to drinking water, and to eliminate such sources of possible contamination. For practical purposes the survey was limited to those consumers likely to use water for other than simple domestic purposes and included the factories, industrial plants, laundries, theatres, hotels, bottling plants, buildings over three stories in height, and stores with two or more floors. This survey was originally carried on largely by full time health inspectors of the larger cities of the state.

Because of many changes due to war production, it was considered important to extend this survey and, since 1943, 26 communities were surveyed by sanitary engineers of the Department of Health. The data presented include only the results of studies from 1943 to the present. Participation of the local health department and water utility was stressed—both to reveal such hazards to their representatives and to assist the engineers in having the hazards corrected.

The results of this survey indicate that a considerable number of hazardous piping connections commonly exist in the interior of buildings. Some 624 buildings were surveyed in the 26 communities which ranged in population from 2,000 to 68,000. A summary of the types of connections found shows: 62 cross connections with non-potable supplies; 519 submerged inlets to tanks, etc.; 63 direct connections to sewers. It was pointed out that these connections not only endanger the drinking water supply within the premises but also may contaminate the water in the mains of the public water supply.

The only protection afforded in many cases is the maintenance of normal pressure in the distribution system. Normal water pressure cannot be depended upon within a building because reduction in capacity of piping (from corrosion) may result in negative head on the upper floors of buildings at times of heavy use of water within the building. In addition, the normal pressure in the mains of the public water supply may be lowered by a large fire or by a serious main break in the distribution system.

Lecturer

George E. Russell
Prof. Hydraulics
M. I. T.
Cambridge

Discussor

Arthur D. Weston
Chief Engineer
State Dept. Health
Boston

After the survey was completed in a town, individual forms were filled out in duplicate for each building where any of the above conditions were found; the piping hazard was stated and a recommendation was given for its elimination. Copies of the form were given to the local health officer (together with copies of the state sanitary code regulation pertaining to such hazardous connections), and all cross connections were referred to the water utility (cross connections are expressly prohibited under the code). Dangers were discussed with plant officials at the time of the inspection and in almost all cases they agreed to make satisfactory corrections.

"Responsibility for Water Piping on Consumer Premises," by Warren J. Scott, Director, Bureau of Sanitary Engineering, State Dept. Health, Hartford, Conn.

The problem of eliminating cross connections, back-siphonage connections, and sewer connections from public water supply systems is a large one. Mr. Scott pointed out that state agencies cannot handle this problem alone and recommended local responsibility, with state guidance and assistance, as the proper and most practical approach. In discussing the responsibility for water quality beyond the property line of the customer served, he noted that the U.S.P.H.S. standards have come to be construed as official national standards, despite the fact that they relate only to supplies furnished to common carriers in interstate commerce.

In the six New England States, the percentage of water supplies used by interstate carriers varies widely between states. Data were cited to show that from 6 to 14 per cent of the water supplies of these states are certified for such use. Consideration of the new 1942 standards of the U.S.P.H.S. led to many objections on the part of operating managements. The various state departments of health are required to certify that sanitary defects and health hazards probably do not exist on any water service line used for delivering drinking water to common carriers. Mr. Scott cited as the underlying difficulty the attempt to write into a government regulation the delegation of responsibility for maintenance of conditions which are desirable but difficult of practical attainment—such as conditions on the property of the water user.

The definite public health hazard created by cross connections has long been recognized and the majority of states have adopted regulations prohibiting such cross connections. Much progress has been made in their elimination yet new ones continue to be found. The important questions arising concern first, the fixing of responsibility and, second, the elimination of the dangers. Legally it is probably correct to say that the water works operator is not obligated to carry out inspections to detect sanitary defects on private property, but Mr. Scott believes the water utility does have at least a moral obligation to seek the remedy for known defects.

Either state or local regulations must be enacted to prohibit hazardous cross connections; Connecticut has two regulations of its state sanitary code which apply and this code is enforceable by local health officers. This state has cooperated in advising and assisting local authorities to conduct surveys and has inaugurated corrective steps in various communities. Mr. Scott recognizes that some local health departments, especially the smaller ones, often do not have the trained personnel to make such surveys. A water utility is frequently most capable of making these surveys, but the utility also may lack personnel and may disclaim legal responsibility.

No one method of meeting this need will be universally adequate. It is possible that a cooperative arrangement may be made between the local health department and water utility; a local plumbing or building inspector may be engaged for this work; the state health department can be depended upon to cooperate to the extent of its personnel. The formation of a local committee might decide both the method of making surveys and also delegate responsibility for approval of plans for new water piping on private premises. In all this work the water utility has a decided interest in effecting improvements.

In discussing these papers, Arthur Weston, Chief Engineer, Massachusetts State Department of Health, pointed out that while the public water supplies certified for use on interstate carriers constituted an average of only 10% of the *number* of supplies in the New England states, those so certified are generally the largest supplies and would probably represent at least 75 per cent of the *volume* of water distributed within a given state. He advised that local boards of health should adopt rules and regulations which, when approved by the state health departments, have the authority of law. Cross connections are a serious hazard and, unfortunately, their effect on public health is not generally appreciated unless an epidemic is experienced.

"Doc" Taylor Made a Major and Appointed Chief of Water and Sewage Section

"Doc"-
Major-Chief

Our good friend D. R. ("Doc") Taylor, formerly Supt. of the Roanoke, Va., Water Department before entering the Corps. of Engineers as Captain, has won his spurs as we predicted he would.

Only a short time after promotion to Major and placed in charge of the Florida District of the 4th Service Command, he has now been made Chief of the Water and Sewage Section, Utilities Branch, U. S. Engineers, and transferred to 4th Service Command Headquarters in Atlanta.

"Doc" has taken over the work and duties of Major Leroy Scott, former Chief of Section, who has been assigned overseas duty.

Jackson Proud of Its Sewage Works Park

(Excerpts from Annual Report Jackson, Mich., Sewage Plant)

In addition to the assembly of analytical and operating data on the Jackson, Michigan, Sewage Treatment Plant, the annual report, as prepared by A. B. Cameron for the year ending June 30, 1944, contains several pages of general comment.

Suspended solids increased as did the amount of dry solids removed, and the B.O.D. likewise increased, as did percentage removal.

Use of zinc strips attached to the aeration plate holders has practically eliminated the excessive corrosion heretofore noticed, with the result that no plate holders were replaced. Porosity of the aeration plates was maintained by addition of an occasional shot of chlorine, followed by blowing out of the plates with additional blower capacity.

Jackson is a city where the sewage treatment plant grounds are used by the general public as recreational grounds. Grills, tables, and waste receptacles are installed, as is a fresh water and drinking water fountain immediately adjacent to the picnic grounds, and it is proposed to build a separate comfort station.

The Jackson plant has a connected population of some 50,000, and treated some 3,192 million gallons during the year, at a cost of slightly over $50,000 for operation alone. Cost of operation averaged $20.56 per mil. gal.

Gotaas Made Chief of Division Office of Inter-American Affairs

Lieut.-Col. Gotaas

Harold B. Gotaas, Lieut-Col. in the Sanitary Corps has recently been made Chief of the Division of Health and Sanitation of the Office of Inter-American Affairs, Washington. He was formerly in charge of the Sanitary Engineering Section of the Division.

Col. Gotaas, M.S. Harvard, 1942, was Professor of Sanitary Engineering in the Graduate School of Public Health at the Univ. of North Carolina when he entered the Army. Since June, 1942, he has been assigned to duty in the Office of Coordination of Inter-American Affairs, and has spent a large part of his time in Central and South America organizing and directing field work.

CRENOTHRIX: ALIVE, DEAD, AND ENTOMBED

An Introduction to Microspheres, Ooliths, and Autotrophic Bacteria

By CARL WILSON, Ph.D.
Consulting Technologist
LOS ANGELES, CAL.

AN UNUSUAL episode in the biology of water pipes was recently observed in Glendale, Cal.; an episode which illustrates several of the many parts played by bacteria in water, and which exhibits one phenomenon which seems not to have been previously recorded in water supply literature.

Glendale obtains it water mainly from deep wells along the margin of the Los Angeles river. It contains small amounts of iron and manganese, as well as 10 to 15 parts per million of free carbon dioxide.

Crenothrix Appears

Several years ago Crenothrix, a thread-forming bacteria which derives its energy through the oxidation of ferrous or manganous bicarbonate, appeared in the distribution system where it made itself so completely at home as to arouse the consumers' ire to the breaking point. Facilities for the use of chlorine, or for aeration and sedimentation, were not available; so compromise methods of control had to be adopted.

After trying several methods, it was finally decided to attack the organism through its physiological characteristics. First of these is that Crenothrix, being an autotrophic form, is able to assimilate carbon only from carbonic acid, and can obtain the energy required for this purpose only from the metallic salts mentioned. From this it would appear that, if salts of iron and manganese and the free carbon dioxide (carbonic acid) were removed, Crenothrix would be starved into submission.

To add a bit of interest to the story, it may be recalled that some bacteriologists believe the autotrophic bacteria, including Crenothrix, probably were the first living things to appear in a world which had but recently come from the forge of Vulcan and which consequently was devoid of organic matter. Autotrophic bacteria are able to build their food, and hence their

The Author

bodies, from purely inorganic substances, such as carbonic acid and a few mineral salts, all of which were available in the budding world, thus making the first contributions of organic matter to initiate the long train of changes which would one day make the world habitable for man.

Crenothrix is thought to be one species which has preserved its primitive characteristics down through the ages, thus linking the remote past with the present. Be this as it may, certain it is that Crenothrix and its congeners are found in bog iron ore deposits of geologic age. One such deposit in Connecticut, which was due to the iron precipitating habits of Crenothrix, furnished the ore from which American patriots cast the first cannon used against the British in the Revolutionary War.

Combative Treatment

But back to Glendale. To absorb carbon dioxide (carbonic acid) and to remove iron and manganese from solution, use was made of sodium carbonate, known in the trade as soda ash. Before going further it seems necessary, as contributing to a better understanding of the reactions involved, to interject a word or two about carbon dioxide and carbonic acid for the benefit of non-chemists.

Carbon dioxide is a gas which is a by-product of all physiological activity and of the decomposition of all dead organisms, both plant and animal. It is absorbed from the atmosphere by falling raindrops, and as water moves over and through the earth more is taken up from the soil. When dissolved in water, this gas behaves as though it had taken up a molecule of water to form carbonic acid, according to the equation,

$$\underset{\text{carbon dioxide}}{CO_2} + \underset{\text{water}}{H_2O} = \underset{\text{carbonic acid}}{H_2CO_3}$$

But carbonic acid has never been isolated and probably never can be, for it always breaks down into water and carbon dioxide whenever and however one attempts to obtain it in pure form. For this reason the chemist who analyzes water can measure only the carbon dioxide, which is consequently reported as the gas in all analytical reports.

When sodium carbonate is added to the Glendale water, the following reactions take place:

$$\underset{\text{soda ash}}{Na_2CO_3} + \underset{\text{carbonic acid}}{H_2CO_3} = \underset{\text{sodium bicarbonate}}{2NaHCO_3}$$

resulting in the removal of carbonic acid.—Next,

$$\underset{\text{ferrous bicarbonate (soluble)}}{Fe(HCO_3)_2} + \underset{\text{soda ash}}{Na_2CO_3} = \underset{\text{sodium bicarbonate}}{2NaHCO_3} + \underset{\text{ferrous carbonate (insoluble)}}{FeCO_3}$$

resulting in precipitation of iron. Finally:

$$\underset{\text{manganous bicarbonate (soluble)}}{Mn(HCO_3)_2} + \underset{\text{soda ash}}{Na_2CO_3} = \underset{\text{sodium bicarbonate}}{2NaHCO_3} + \underset{\text{manganous carbonate (insoluble)}}{MnCO_3}$$

resulting in the precipitation of manganese.

A dosage of 22 parts per million of sodium carbonate was used, raising the alkalinity of the distribution system influent to pH 8.3, and it was found to hold the Crenothrix in check to such a degree that complaints due to it and to "red water" fell to the vanishing point. Inasmuch as Crenothrix is still present in water coming from the wells, treatment has been continuous for two or three years.

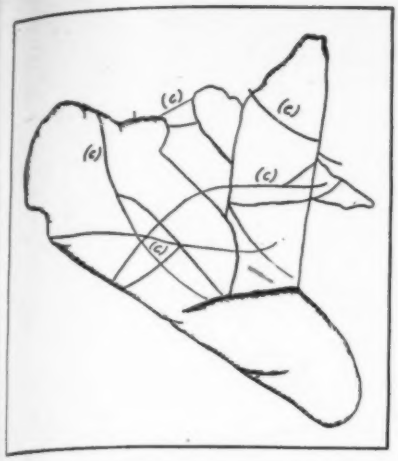


Fig. 1. Calcium Carbonate Ooliths Formed Around Crenothrix Filaments

(Drawn from microscopic preparation by Catherine Straight)

The Ooliths Appear

After this treatment had been in use for several months, the writer's attention was called to "white particles" on the surface of the water in a high service reservoir which floats on the distribution system. Microscopic and chemical examination revealed them to be calcium carbonate ooliths, formed about filaments of Crenothrix. These ooliths were less than half a millimeter in maximum dimension, oval in shape, of a yellowish white color. Sometimes several would be united into a stellate group. On dissolving them in dilute acid under the microscope, they were all found to have at least one filament of Crenothrix acting as the core; while most of them enclosed several such filaments, as shown in the accompanying drawings.

To understand the production of these ooliths, which apparently have never before been reported from water mains, it is necessary to digress a moment to consider some fundamentals of biology. First, let it be recalled that every living entity exerts some effect on its environment, and that the environment, in turn, exerts an effect equal in amount, although different in kind, on that entity.

Secondly, one must realize that an environment may be large or small, and in the case of bacteria busily at work in a water pipe the "environment" becomes so small as to be almost or even quite microscopic. This concept is necessary if we are to explain what happens within a speck of bacterial slime adherent to a pipe wall. Conditions within such a microsphere, because of its colloidal character, are remarkably different from those in the flowing stream of water a fraction of a millimeter distant.

Thirdly, carbon may occur in the Glendale water in three forms; viz., as free carbonic acid (H_2CO_3); as calcium bicarbonate ($Ca(HCO_3)_2$), and calcium monocarbonate ($CaCO_3$) (often called "normal" carbonate). The latter is only very slightly soluble in the absence of carbonic acid but, in its presence, becomes converted into the freely soluble bicarbonate. When free carbonic acid is present in excess, all monocarbonate is so converted, and only calcium bicarbonate and free carbonic acid are present. When carbonic acid approaches the vanishing point, some calcium bicarbonate gives up half of its carbonic acid to restore the balance between the two forms, with the production of monocarbonate.

$$(Ca(HCO_3)_2 \rightleftharpoons H_2CO_3 + CaCO_3)$$

Now, bearing these fundamentals in mind, we may return to the ooliths. Crenothrix forms long chains of bacterial rods, encased in a sheath of gelatinous material, and is attached at one end to some stationary object, usually the pipe wall, but sometimes to particles suspended in the water. The bacteria derive their food and energy from substances dissolved in the water which is held within the gelatinous sheath. Movement of liquid in this jelly is slow, giving time for profound changes to occur among chemical substances dissolved in it. The bacterial cell abstracts its food and returns its waste products to this slowly changing water; one of the consequences being the rapid removal of carbonic acid, which is consumed by autotrophic bacteria faster than they excrete it as a physiological by-product.

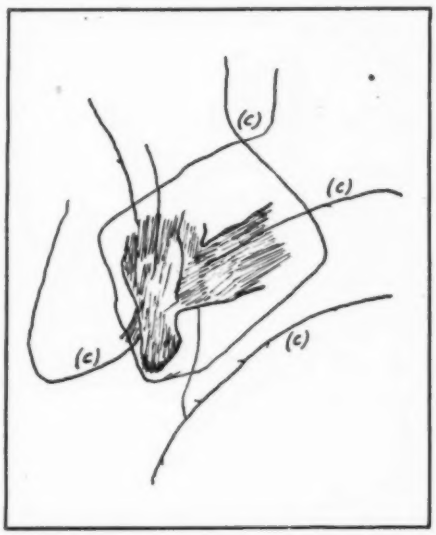


Fig. 2. Partially Redissolved Oolith and Formerly Encased Crenothrix

(Drawn from microscopic preparation by Catherine Straight)

After treatment with sodium carbonate, water in the distribution system still contains three or four parts per million of carbonic acid. The drop of water in the micro-environment inhabited by Crenothrix would contain perhaps a few ten-thousandths of a milligram of carbonic acid, an amount which would soon be consumed, after which the calcium bicarbonate present would give up its half-bound carbonic acid to restore the equilibrium, being in turn precipitated as insoluble monocarbonate, thus building up the oolith.

Sooner or later the oolith breaks away from its attachment to fall to the bottom of the pipe, or to be swept onward by the flowing water. An accumulation of them in the invert had been carried to the high service reservoir where they were deposited on the sloping walls. When heavy draft lowered water in the reservoir, the ooliths on the exposed sides dried out, and later when the water rose again they floated on the surface, being buoyed up by air which had penetrated their porous structure, thus calling attention to their presence.

The Marble Sarcophagus

In the formation of ooliths Crenothrix acted on its environment by removing carbonic acid therefrom, and in response to an inviolable chemical law, environment reacted on the organism by releasing half-bound carbonic acid from calcium bicarbonate to restore the balance. In precipitating, calcium monocarbonate environment encased the Crenothrix filament in a shining white "marble sarcophagus" (marble is a particular form of calcium carbonate), destroying its life, but embalming and preserving its remains intact, so permitting the prying eye of science to unravel the role of implacable environment, which offers prodigal life with one hand while dispensing inevitable death with the other. The micro-world, though devoid of sentiment, holds tragedies as great and as relentless as any which beset the way of man.

Farther down the pipe the oolith may lodge amid a deposit of organic matter, or upon a mass of bacterial slime. In either situation abundant carbonic acid is liberated by bacterial action, and the excess of the acid in this new environment exerts a solvent action upon the oolith. That

this occurs in the Glendale distribution system has been amply proved by the finding of ooliths which had been partially dissolved.

These experiences at Glendale remind us of the importance of life and living processes in the problems which arise in distributing water through pipes. They give a hint of the changes which occur as water moves through the system, and they accentuate the reality of the micro-environment and the part it plays in heretofore obscure phenomena such as tuberculation and pitting of iron and steel mains. They suggest new and fertile fields for study of a little known branch of economic bacteriology and encourage the belief that through a more intimate knowledge of slime growths and the biochemistry of micro-environments lies the road to more palatable water in service.

Life Insurance from the Buyer's Point of View

Authored by E. C. Harwood and Bion H. Francis, and published by the American Institute for Economic Research, of Cambridge, Mass., a pocket sized book on *Life Insurance* has proved of considerable interest to us. There is probably no other place where a buyer can obtain so much good information on life insurance for the sum of one dollar.

Not being a profit organization, and with no axe to grind, the authors and publishers present what appears to be good advice, free from any particular sales argument, other than the soundness of life insurance, both as an investment and as insurance.

For example, among the things one can learn from this book are what the table of mortality is, what life expectation really means, what ordinary life insurance is, what term insurance is, what cash surrender is, what insurance costs and why, and so on.

How much insurance should a man carry? Should you ever drop a policy? How should one choose a company? What is an annuity? Why consider an annuity? What are you paying for when you buy insurance? What is the reserve an insurance company is required to carry? All of these and many more questions are answered in this little book.

Did you know that insurance costs more in some companies than in others? Do you know why it is better to buy from an old well established company than a young company? Do you know why you are given a medical examination, and what kind of policies require no examination? These are still more of the questions answered by the book. Of course there are some chapters that are dry reading and some that become a little involved in the details of insurance company organization, but by and large it is not difficult to understand.

The authors have no connection with any insurance company and the Am. Inst. of Econ. Research is independent of all commercial interests and we have every reason to believe that the book will be helpful to any of our readers who are interested in life insurance. It is a remarkable guide which may result in many dollars saved by the reader. We asked an insurance friend of ours and he too said it was a good book.

This may seem a bit unusual to tell our readers about a book that has nothing to do with water works or sewerage but we believe our readers are human beings, too. And human beings should be interested in insurance and know something about it before buying. Or the reader may learn of advantages from converting existing high cost policies into lower cost policies. Hence this review. (G. E. S.)

Federation's Manual of Practice No. 1 on Occupational Hazards

True to the promise of W. H. Wisely, Exec. Secy. of the FSWA, made at the 16th annual meeting of the Federation in Pittsburgh, the first Manual of Practice has been issued.

This Manual, prepared under the direction of the Committee on Sewage Works Practice by the Sub-Committee on Occupational Hazards, is devoted to a discussion of hazards in the operation of sewage works; sewage works being defined as including collection, transportation, pumping, treatment, and final disposition of sewage.

The scheme of presentation of the material, in the book of 53 pages, follows the general scheme of the symposium on safety given by the members of the sub-committee at the Federation meeting in Pittsburgh. Material covered by the book includes the nature of hazards and data on accidents in sewage works, the prevention of physical injuries, prevention of body infections, prevention of dangers from noxious gases, safety equipment, and recommendations. Three appendices present a list of accidents, the safety code of NESWA and NYSSWA and a partial list of manufacturers of safety equipment.

Individual topics covered include everything from the design of sewers to resuscitation. In the case of each of the main topics, safe practices to overcome the hazard are presented.

The sub-committee, under the chairmanship of LeRoy W. Van Kleeck, including Messrs. Ash, Brown, Doman, Ingram, Langford and West, deserves much credit for an extremely useful manual. If succeeding manuals in the series are as well done, the Federation can be well proud of its work and its service to its members.

While a copy of the Manual has been sent to each member of the Federation, additional copies may be obtained by members for $0.25 each or by non-members for $0.50 each. Write to W. H. Wisely, Exec. Secy., Federation of Sewage Works Assns., 325 Illinois Bldg., Champaign, Ill.

George Coffin Opens Cons. Office

George W. Coffin has announced the opening of a consulting engineering office at 68 Devonshire St., Boston 9, Mass. Mr. Coffin, who is well known throughout New England, will specialize in water and sewerage works, flood control and drainage, investigation, design, estimates, and valuation, as well as chlorine sterilization of water systems, reservoir treatment and algae control. Mr. Coffin has until recently been sanitary engineer, U. S. Naval Air Station, Quonset Point, R. I.

Utility Operations Profitable in Midland, Mich.

Combined Management Shows Net Income of $44,809.93

Paul Stegeman, Sup't of Water and Sewage Dep't of Midland, Mich., not only writes an interesting and complete report on the operation of the two services each year, but he also abstracts the main features of the report and presents a one page summary of the most pertinent facts, that "he who runs may read."

While water pumpage increased 3 per cent over the previous year, the net income ($42,697.53) before depreciation increased 40.5 per cent over 1943. The sewage utility had a net of $2,112.40 before depreciation. These records were possible because of good management and operation and decreased operation costs. The cost of sewage treatment dropped from $1.55 per capita in 1943 to $1.35 in 1944. Included in the costs for operation of the sewage treatment plant was a repayment to the water department of a $6,000 loan made when the plant was built.

The hardness of the treated water decreased during the year at no increase in cost of operation and experiments were carried on with new zeolite softener to further improve the quality of the water. An application has been made to the State Planning Commission for aid in plans to increase the water plant to a capacity of 8 mgd. from its present 4 mgd.

The sewage plant handled 770 tons of garbage which was ground and digested with no particular difficulty, and 611 yards of digested wet sludge were used by the parks department; the rest was filtered.

It is apparent from the Midland report that combined management of water and sewage utilities and sewer service charges pays.

SEVENTEENTH ANNUAL MEETING OF N. Y. STATE SEWAGE WORKS ASSN.

By HARRY A. FABER*
Editorial Associate

THE New York State Sewage Works Association demonstrated that a full program can be provided in a one-day meeting properly planned and directed. Meeting in New York on January 19th, following sessions of the Sanitary Engineering Division of the A.S.C.E., the Association program included two technical sessions with President William H. Larkin presiding and a noon luncheon with W. H. Wisely and Charles A. Emerson as speakers.

Mr. Wisely, Executive Secretary-Editor, Federation of Sewage Works Associations, brought members up to date on Association affairs. At present, it is planned to petition Washington authorities later on for official permission to hold the Federation meeting next fall in Toronto, as scheduled, and the outcome will be announced by the Board of Control. It is urged that local meetings be held and arrangements made so as the limitations on such meetings set by the National War Committee on Conventions are not exceeded.

Honored Guests

Chas. A. Emerson
Consulting Engr.
New York
(Past Pres., Sewage Wks. Federation)

Dr. A. E. Berry
Ont. Dept. Health
Toronto
(President, Sewage Wks. Federation)

Mr. Wisely announced with pride the publication of the first section of the Manual of Sewage Works Practice—the first of a series of sections planned—and congratulated LeRoy W. Van Kleeck and his committee for their accomplishment. Post-war planning activities of the Federation will be continued and it is stimulating to note that almost a billion dollars in sewage construction has already been planned and approved or is under design for post-war construction.

Emerson Reviews Sewage Treatment

Guest speaker, Charles A. Emerson, Havens and Emerson, Consulting Engineers, New York and Cleveland, described what he termed "Some Early Steps in Sewage Treatment." This constituted a fascinating review of historic developments (and the men responsible for them) in this field, which today boasts about 6,000 sewage treatment plants serving 40 million of our population.

The early concept was that sewage treatment is required to abate nuisance and permit the use of rivers, despite the fact that the germ theory of disease was then recognized. Even experts still believed that polluted water would purify itself in a short distance of travel down stream.

The Massachusetts legislature created the famed Lawrence Experiment Station and, in 1887, for the first time, engineers, chemists and biologists worked together on the problems of sewage treatment. Among other milestones, Mr. Emerson discussed the development of intermittent sand filtration, chemical precipitation, trickling filters, and the newer methods. He pointed to the rich heritage of great men and great accomplishments, then indicated that the opportunity and the needs today are equally pressing.

Presidents

(Retiring)
Wm. H. Larkin
Distr. San. Engr.
State Health Dept.
New York

(Incoming)
Dr. Geo. E. Symons
Assoc. Editor
"Water Wks. & Sew'ge"
New York

William R. Copeland (Hartford, Conn.), one of the original chemists on the staff of the Lawrence Experiment Station, was present at the meeting and was recognized.

Kenneth Allen Awards

The Kenneth Allen Memorial Award of the Federation was presented by its President, A. E. Berry (Ontario Dept. Health, Toronto, Canada), to C. A. Holmquist, Director, Division of Sanitation, New York State Department of Health. Dr. Berry credited Mr. Holmquist with many important and noteworthy contributions to the founding as well as the successful growth of the New York Association. In accepting the award, Mr. Holmquist generously gave full credit to his associates in the Division of Sanitation who have taken active part in the conduct of Association activities.

Award Winners

Dr. Gail P. Edwards
Chief Chemist
Ward's Is. Treatment Wks.
New York City

Dr. Harry W. Gehm
Technical Advisor
Natl. Council for Stream Improvement
New York, N. Y.

H. H. Wagenhals (District Engineer, State Department of Health, Syracuse) next made the presentation of Kenneth Allen Memorial Awards which the New York State Sewage Works Association gives each year to the authors of the papers presented at its meetings, published in the Journal, and judged best by the Award Committee. The award for the best research paper went to Dr. Harry W. Gehm, Jr. (this award was actually for two published papers, one on the treatment of acid wastes and one on the treatment of laundry wastes). The award for the best operator's paper was presented jointly to Dr. Lloyd R. Setter and Dr. Gail P. Edwards for their paper on "Modified Sewage Aeration"—Part II.

New Vice-Pres.

Uhl T. Mann
Sup't Treatment
Syracuse, N. Y.

Secy.-Treas.

Arthur S. Bedell
State Dept. Health
Albany, N. Y.

*Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

New Officers

The following officers were elected to serve for the 1945-1946 term:

President, Dr. George E. Symons, Associate Editor, *"Water Works and Sewerage,"* New York, N. Y.

Vice President, Uhl T. Mann, Supt. Sewage Treatment, Syracuse, N. Y.

Elected to Executive Board

Al E. Martin
Com. Public Wks.
Town of
Tonowanda
Kenmore, N. Y.

Jas. C. Harding
Com. Public Wks.
Westchester
County
White Plains, N. Y.

Secretary-Treasurer, A. S. Bedell, Division of Sanitation, State Department of Health, Albany.

Assistant Treasurer, J. C. Brigham; *Assistant Secretary,* A. W. Eustance, both of the Division of Sanitation, N. Y. State Department of Health.

Federation Board of Control Members, Edw. J. Smith, Supt. of Sewage Disposal, Niagara Falls, N. Y.

To the Executive Committee, Jas. C. Harding, Comm. of Public Works, Westchester County, N. Y.; A. L. Martin, Comm. of Public Works, Town of Tonawanda, N. Y.; Benj. L. Smith, Consulting Engr., Albany, N. Y.

Dr. Symons, as incoming president, presented the Association key and a certificate to the retiring president, William H. Larkin.

"Practical Application of Principles of Modified Sewage Aeration," by Lloyd R. Setter, W. T. Carpenter, and George C. Winslow, respectively Principal Sanitary Chemist, Senior Chemist, and Engineer in Charge of Jamaica Sewage Treatment Plant, New York, N. Y.

This paper was presented by Dr. Setter, who described the manner in which any degree of treatment between plain aeration and activated sludge can be provided in the flexible Jamaica sewage plant. In the present studies the aeration period was varied from 1 to 4 hours, the return sludge volume ranged from zero to four times the total sewage flow, and suspended solids were maintained at a figure usually below 600 to 800 ppm. This control resulted in the dense final sludge which settled well without bulking.

Results were presented for a fourteen-month operating period subsequent to laboratory and pilot plant studies of the conditions selected. The Jamaica plant is equipped with coarse and fine screens, grit chambers, two spiral flow aeration tanks, eight final settling tanks, air lifts for sludge return, two sludge thickeners, twelve digesters, three gas engines, and with chlorination facilities for effluent disinfection during the bathing season. The average sewage flow is 35 mgd. and normal sludge return is 6 mgd.; with these volumes, one aerator provides 2.4 hr. detention and two aerators 4.8 hr.; average detention in the final settling tanks is 2.8 hr. and only 3.8 hr. is theoretically required for sludge removal.

During these tests, average characteristics of the plan influent were: suspended solids 193 to 283 ppm., B.O.D. 105 to 155 ppm. Since eight periods of varying loading factors were studied, the data cannot be readily summarized, except to note that the percentage removal of suspended solids varied from about 65 to 87 per cent and of B.O.D. from about 55 to 73 per cent. It was demonstrated that in an aeration period of 4 to 5 hours, removals of 85 per cent in suspended solids and of 75 per cent in B.O.D. could be accomplished; in an aeration period of 2 to 2.25 hours, removals can reach 83 per cent in solids and 70 per cent in B.O.D. Only one sludge thickener was usually employed during the tests, yet a 5 to 7 per cent concentration of solids was obtained in the sludge sent to digesters.

Robert Shapiro, Department of Public Works, discussed the operation of the Bowery Bay sewage plant of New York City. Originally the step aeration process was employed at this plant and comparative data was given for the modified sewage aeration process which has been in use at the Bowery Bay plant for over one year. The latter process has, in general, resulted in equally good removals of solids and of B.O.D. with a power saving of over 20 per cent and has produced a denser sludge which improved plant operation.

E. S. Chase, Consulting Engineer, Boston, Mass., asked Dr. Setter concerning the variation in biological growths under varying operating conditions. The micro-organisms in wall films were described as quite different when high solids or low solids are maintained.

Dr. F. W. Mohlman, Sanitary District of Chicago, commented on the process as one in which high efficiency was anticipated with reduced costs. He noted that the pounds of B.O.D. removed at a given cost or for a given volume of air provides the best measure of efficiency. Selection of any given process or method of operation as preferable will be determined by the characteristics and variation of the raw sewage, by its degree of freshness and ash content, and by the industrial wastes which it contains.

"Exploring the Effect of Heavy Doses of Chlorine on Sewage," by A. E. Griffin, Assistant Director, and N. S. Chamberlin, Sanitary Chemist, Technical Service Division, Wallace and Tiernan Co., Inc., Newark, N. J.

Full credit as the first to explore the reaction of heavy doses of chlorine on sewage was accorded by Mr. Griffin to Dr. Frank E. Hale. In 1927, Dr. Hale, Director of Laboratories, New York City Board of Water Supply, published data concerning sewage treatment plants on the city watershed. His studies indicated chlorination of the effluent resulted in a loss of nitrogen, approximately in the ratio of 1:7.5 nitrogen to chlorine. Subsequent investigators have made some investigation of the effect of chlorine on B.O.D. reduction and on the destruction of albuminoid ammonia.

The present laboratory studies, made by the authors at the Indianapolis Sewage Treatment Plant, employed standard methods throughout. Ammonia was determined by direct nesslerization and by distillation. Residual chlorine was removed by sodium sulfite. Four types of samples were included: raw screened sewage, settled effluent, activated sludge effluent, and combined plant effluent. A wide range of chlorine dose was covered.

The raw sewage investigated showed a break-point at about 225 ppm. chlorine dose, the settled effluent was approximately the same, a combined effluent (95% plain aeration effluent, 5% activated sludge effluent) showed a break-point at about 125 ppm. In the activated sludge effluent samples, there was no sharp break-point but a chlorine dose of only about 6 ppm. appeared to produce the maximum effect—presumably this effluent was very low in free ammonia.

These break-point data were shown graphically by means of the slides which also pictured the corresponding reduction in ammonia content. Of special interest was the fact that removal of free ammonia from sewage appears to be accomplished in direct relation to the chlorine dose, unlike the removal of free ammonia in water where the removal is not progressive but, instead, occurs only when the break-point dose of chlorine is approached and then proceeds rapidly.

Fed. Board of Control Representatives

(Outgoing)
C. Geo. Andersen
Supt. of Sewerage
Rockville Center,
L. I.

(Incoming)
Edw. J. Smith
Supt. of Disposal
Niagara Falls,
N. Y.

(Smith succeeds Andersen at the close of the 1945 Sewage Wks. Federation Conference.)

Another important factor emphasized by these results is that chlorination, irrespective of the dose, appears to have no appreciable effect on the albuminoid ammonia content. The reductions in B.O.D., resulting from break-point chlorination of sewage samples containing free ammonia, were too low to indicate this treatment to be generally practical for such a purpose. Only in the case of activated sludge effluent does break-point treatment for B.O.D. reduction appear of value.

Prof. C. J. Velz, Manhattan College, New York, noting that the majority of results shown were based on an 18-hour contact period, asked if shorter contact periods would be practical. Mr. Griffin replied that the long contact period was employed in drawing graphs since it demonstrated the effect of high chlorine doses more strikingly.

L. H. Enslow, Editor, *Water Works and Sewerage,* New York, commented on actual experiences in which the quality of receiving streams showed considerable improvement when chlorination of sewage effluents was inaugurated. In such instances break-point chlorination had not been practiced, but of practical interest were the observations reported first by Hale, and now confirmed by Griffin and coworkers, that the free ammonia nitrogen is reduced progressively by chlorine in moderate dosages. It seemed likely that the clearing up of algae growths in streams receiving chlorinated effluents containing residual chlorine might be explained by the fact that much of the free ammonia is destroyed by chlorine, and also that antiseptic chlorinated products are formed when chlorinating effluents rich in nitrogen.

Programmers

Dr. W. Rudolfs
Chief
Water & Sewage Research
Rutgers Univ.
New Brunswick, N. J.

L. Fontenelli
Supt.
Treatment Wks.
Rahway Valley
Rahway, N. J.

"Relation Between Loading and Supernatant Liquor in Digestion Tanks," by Willem Rudolfs, Chief, Dept. of Water and Sewage Research, New Jersey Agricultural Experiment Station, and Louis Fontenelli, Chief Operator, Rahway Valley Sewage Treatment Plant.

In his usual comprehensive fashion, Dr. Rudolfs related this study of sludge digestion to plant operation—stressing the importance of a rapid and effective separation of liquor and solids, since this condition affects the capacity of digestion space available, the concentration of the resulting sludge solids, the subsequent handling of the sludge, and the drying of the sludge. Certain factors not clearly established — such as the volume of supernatant to be expected, various methods of adding fresh solids, and the effect of high loadings on operation—were investigated in order to provide a basis for standardized data.

The studies indicated that, as the concentration of solids in added sludge is increased, the percent of supernatant liquor decreases. A rapid separation of liquor occurs at first and then decreases in rate when gas production is at its maximum. When the sludge load added to a digester increases, the volume of supernatant liquor which can be withdrawn decreases. Extensive operating results from the Rahway Valley plant (where the digestion period provided averages one week and may be two weeks at a maximum) indicate that 40 to 45 per cent of the sludge may separate as liquor—which is a larger volume than that shown in laboratory studies. Digestion temperature was shown to affect liquor separation and overloading the digester greatly reduced the amount of supernatant.

Based on the results reported, it is concluded that each 1.0 cubic foot of primary digester capacity can handle 0.1 pound of fresh solids per day at a temperature of 82-84° F. If a higher solids concentration is required or if industrial wastes are present a larger digester capacity will be required. Two stage digestion units are considered fully loaded when about 40 per cent of added sludge may be withdrawn as supernatant liquor.

In reply to a question from **N. I. Kass** (Div. of Sanitation, New York City), Dr. Rudolfs defined as supernatant liquor that which contains no more than 2,000 ppm. solids; if the solids content is greater than that figure, it would be termed thin sludge or sludge.

"Coordinated Industrial Waste Research," by Harry W. Gehm, Technical Advisor, National Council for Stream Improvement, Pulp, Paper, and Paperboard Industries, Inc., New York.

Dr. Gehm described the plan of research which has been developed to move from research at individual mills to a broad plan of pollution correction by the National Council. The program includes cooperation between technically qualified groups in seven regional committees. Considerable knowledge has been accumulated concerning waste treatment in research sponsored by individual companies which are now members of the Council.

The Mellon Institute is to carry on research in a wide variety of problems. As it is now recognized that streams must serve for disposal of wastes—but that they must not be overloaded—a study of this aspect is included; a technical evaluation of processes in use and under development is to be made by Prof. Velz at Manhattan College.

"Plant Scale Tests on Thermophilic Digestion," by Anthony J. Fischer, Development Dept., The Dorr Co., Inc., New York, and R. A. Greene, Chemist, Sewage Treatment Plant, Jackson, Mich.

Programmers

Dr. A. J. Fischer
Development Engr.
The Dorr Co.
New York

A. E. Griffin
Tech. Service Div.
W. & T. Co.
Newark, N. J.

Dr. Fischer cited laboratory tests of digestion at high temperatures and plant tests made in 1931; these indicated rapid digestion could be accomplished but that several operating difficulties must be solved before the process became practical. When it appeared that stage digestion might provide the solution, new studies were started in 1942 at the Jackson sewage plant. Parallel tests were made using two 50 and one 60-foot tank in each series.

Results indicated a more supernatant liquor to be produced in the thermophilic digestion than in the usual mesophilic digestion. Sludge from the first type was found to dry as well or better than the second type. The greatest difficulty was experienced in temperature maintenance, and a rise or fall of as little as 5 degrees in temperature in one day was found to seriously disrupt the digestion process.

Tests show hot water coils to be quite unsuitable for heating to the 125 to 130-degree temperature found most desirable; odors are produced at 140 degrees and digestion is upset at 115 degrees. A heater was designed for direct steam heating using partially softened water and proved quite applicable. The heat requirements were about twice as great for the thermophilic digestion as for mesophilic digestion (heat losses were very high because the units were not designed for such service) but heating only of the primary stage tanks was required.

About 1.6 times the normal sludge loading can be used and a superior sludge as well as more gas can be produced in the thermophilic digestion process. Dr. Fischer stated, however, that this process would be attractive only when an ample supply of gas or waste heat was available; that it appeared not suitable for new plants on an economic basis.

SOLVING AN OIL WASTE PROBLEM THROUGH INDUSTRY COOPERATION

By I. O. LACY, Supt.
Sewage Treatment Works
LOCKPORT, N. Y.

The Author

LOCKPORT, N. Y., placed its primary sewage treatment plant in operation on Nov. 4, 1940, and it was obvious at the time that a heavy oil waste would cause trouble. It was easy to trace its source to the Harrison Radiator Co., a division of General Motors. This plant has in its manufacturing process the rolling of copper strips into thin sheets. Oil is used as a lubricant and water as a coolant. Investigation revealed that approximately 250 gallons of oil were being wasted each day. Friendly contacts and conferences brought about effort on the part of the company to install a recovery process for this wasted oil. In the meantime, however, accumulation of the oil at the treatment works caused considerable difficulty.

Oil in the Wrong Place

This waste oil collected on the surface of the clarifiers and after being pushed into the pan by the skimmers, the oil ran to a sump, from which it was pumped into the digesters.

No digestion occurred and it was decided to construct a lagoon for the total contents of 100,000 cu. ft. Fortunately, there existed a depression nearby, adequate to receive the entire volume.

The lagooned material had a strong odor which did not disappear when the material was treated with ferric chloride or lime; calcium hypochlorite helped some but treatment with sodium hypochlorite was most effective. After drainage and drying the sludge-oil mixture was ignited. It burned fiercely with a heavy black smoke.

Recovery of Oil at the Industrial Plant

In order to remove the oil waste from the cooling water and thereby eliminate it from the sewers, the Harrison Radiator Co. designed and built a special separation system.

Burning oil and sludge in lagoon

The system consists of collecting lines running from the rolls to a sump, and two steel tanks, 33 ft. high by 10.5 ft. in diameter. The waste enters one tank about 11 ft. from the bottom and is distributed through a pipe arrangement supporting a cross with each of the four arms, leading from the cross, ending in a tee topped riser pipe.

The oil rising to the top of the tank is drawn off over a V-notched wier cut into a 4 ft. section of 6-in. closed end iron pipe, the elevation being adjustable. The collected oil flows by gravity through a flexible hose to an iron pipe joining the tanks. A similar wier arrangement exists in the second tank.

In the pipe portion of the line is a Wheelco Hydrometer valve; this valve and a similar valve in a fixed pipe line joining the tanks near the base are controlled by a Wheelco 1256 electrode. When oil touches the electrode, the top valve is opened and oil flows through the line to a connected storage tank; the bottom valve is then closed so there is no flow between the tanks. When water touches the electrode, the valve closes automatically. The second tank is float operated, with the water being drawn off through a loop near the bottom.

The water is either reused or sent to the sewer. The oil is burned. All lines are vented above liquid level. There is some copper in this waste, much of which settles out but some remains with the oil causing abrasion of the burner tips.

Since the waste recovery system has been in operation, practically no oil has been received at the sewage treatment plant. The success of this elimination of a troublesome problem has shown that it is both feasible and practical to cooperate with industry where a severe waste problem exists.

CYANIDE REMOVAL FROM METAL FINISHING WASTES

A Method of Treatment Involving Chlorination for Destruction of the Cyanides

By

FRANCIS S. FRIEL
Albright & Friel, Inc., Consulting Engineers
PHILADELPHIA, PA.

and

GORDON J. WIEST
Technical Service Dep't, Penn. Salt Mfg. Co.
PHILADELPHIA, PA.

THE problem of providing a satisfactory treatment of an industrial waste containing variable quantities of highly toxic chemicals, including cyanide compounds, was recently solved for an aircraft factory. The complete removal of all the toxic constituents in the metal finishing wastes was required. The reduction of the toxicity to a minimum lethal limit by partial treatment was not a satisfactory solution to the problem.

The wastes were those resulting from metal finishing and included anodizing, various metal plating processes, metal cleaning, the associated processing wastes and the rinsing waters. The industry was subject to a war-born expansion into a rural area which required the management to provide facilities unknown to them prior to the expansion. These facilities included a sanitary sewer system, a sewage treatment works, water supply, industrial wastes treatment, and other facilities usually available in a city.

The factors determining the degree of treatment required for the metal finishing wastes were:

(1) The industry was located on the divide of two very important watersheds used as domestic water supplies.

(2) The dilution in the streams of these watersheds was insufficient to allow discharge of any wastes carrying toxic constituents, especially with the knowledge that the concentration of any one or all of these toxic constituents might vary in limits not acceptable to determinate factors of control.

(3) The discharge of wastes could not be subjected to dilution control or to a simple indeterminate pretreatment since the discharge was controlled by the requirements of production by the industry.

(4) The theoretical and known cumulative effects of these toxic constituents on the flora and fauna of the streams as related to the source of water supply.

(5) The effect on the biological sewage plant such as accumulative reaction of chromic acid on the digestion of sewage sludge and the various reactions of cyanides on the trickling filters in its release from the various separations of solids. The sewage plant did not offer any safe considerations to the long-term requirements.

The Authors
F. S. Friel Gordon Wiest

It was concluded that it was not scientifically sound practice to attempt to establish a minimum lethal concentration or a maximum dilution for the wastes carrying toxic constituents in the concentrations known to be required by variations in the production of the industry. On the basis of these findings a treatment plant was designed and constructed for the complete removal of all toxic constituents of the waste. "Batch" treatment procedures were determined as the most practical in the operation for the plant.

The Treatment Process

Briefly, the treatment process provided employs chemical precipitation for the complete removal of the toxic constituents other than the cyanides. Views of the plant are shown in the accompanying photographs and flow diagram. The following discussion relates to the treatment provided for the complete removal of cyanides only:

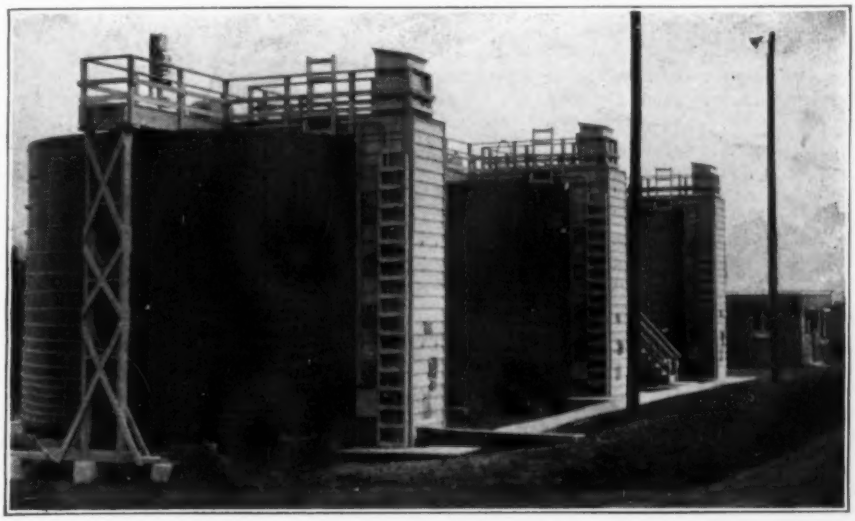
The treatment for the removal of cyanides was based on the chlorination of the waste following the separation and removal of the other toxic constituents. The use of the chlorine was based on the reaction of the cyanide salts with chlorine through a contact tank with a retention period of 20-30 minutes. The chlorine reacts with the cyanides to form cyanogen chloride. This lethal compound, however, rather quickly hydrolyzes to ammonium carbonate in the presence of hydroxide alkalinity. The innocuous ammonium carbonate is unstable in this case and becomes free ammonia and carbon dioxide.

The explanation of the reaction of the cyanides with chlorine is set forth in the following equations:

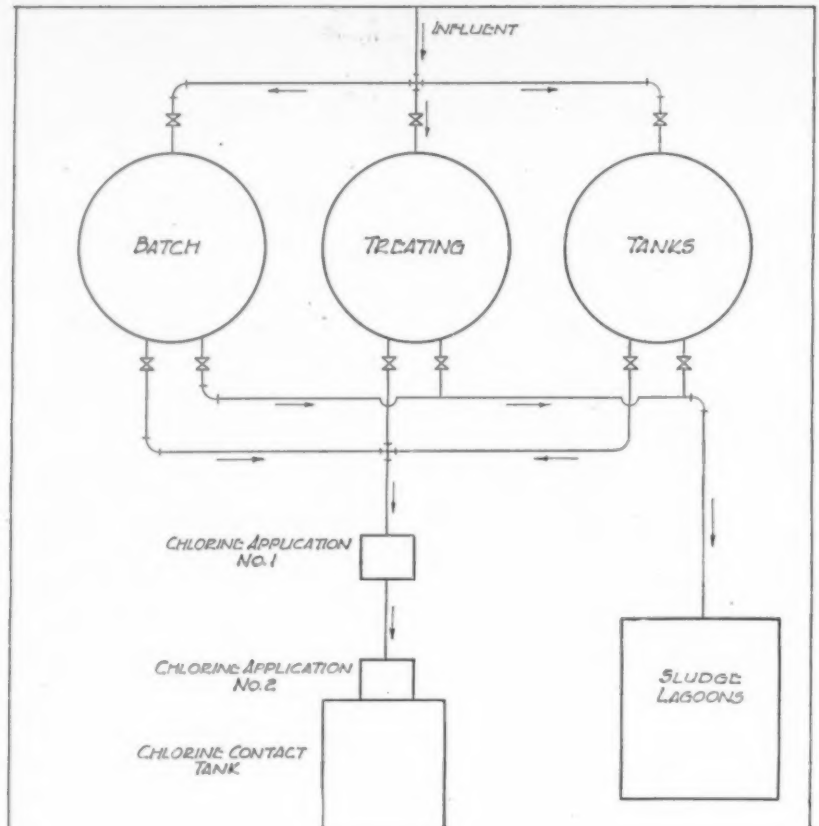
(1) $H_2O + 3\ NaCN + 3Cl_2 \rightarrow 3CNCl + 3NaCl + H_2O$

(2) $3CNCl + H_2O \rightarrow C_3N_3Cl_3 + H_2O$

(3) $3H_2O + C_3N_3Cl_3 + 6NaOH \rightarrow 3NaCl + 3NaOCN + 6H_2O$



Batch Treating Tanks



(4) $2NaOCN + 4H_2O \rightarrow (NH_4)_2\ CO_3 + Na_2CO_3$

(5) $2H_2O + 2NaCN + 2Cl_2 + 4NaOH \rightarrow 4NaCl + (NH_4)_2\ CO_3 + Na_2CO_3$

(6) $(NH_4)_2\ CO_3 \rightarrow 2NH_3 \uparrow + CO_2 \uparrow + H_2O$

The use of chlorine and its reactions with the cyanides was investigated on a laboratory scale and further on a semi-plant scale before the treatment plant was constructed.

A treatment plant was built and has been operating for more than eighteen months consistently producing an effluent free from cyanides and other toxic constituents. The volumes of the wastes vary in quantity and quality and complete laboratory control is exercised on the treatment process. The treated effluent is examined continuously during discharge to the outfall sewer and checked again in the stream.

Determination of Cyanide

Various analytical methods for the determination of cyanides were used in the procedures of investigation of this problem. The methods described in APHA Standard Methods for the Examination of Water and Sewage did not meet the range of sensitivity required. Doebner's Reagent, Lea's Reagent, Stamm's Reagent, and Guaiconic acid solution were among the test solutions used in determining cyanides. The method adopted for operational use follows:

Place 10 ml. of sample in a crucible, add two drops of ten per cent solution of sodium hydroxide; place on hot plate and dehydrate.

Add one drop of two per cent solution of ferrous sulfate and allow to stand for fifteen minutes.

Add two or three drops of hydrochloric acid and warm on hot plate; add a few drops of distilled water. If cyanide is present, the test solution will turn a blue-green.

The quantity of CN is determined by the preparation of colorimetric standards using known increments of salts of cyanide.

The effluent from this waste treatment plant has been constantly examined by responsible agencies in the area and the reports have been highly satisfactory.

The problem was investigated and studied jointly by Metcalf & Eddy, Consulting Engineers, Boston, Mass.; Albright & Friel, Inc., Consulting Engineers, Philadelphia, Pa.; and Gordon J. Wiest, who was at the time the representative of the aircraft industry. Suggestions presented by L. H. Enslow, Editor of *Water Works and Sewerage*, and H. A. Faber, Research Chemist, The Chlorine Institute, were most helpful. The plant was designed by Albright & Friel, Inc., and operated for 12 months by Gordon J. Wiest.

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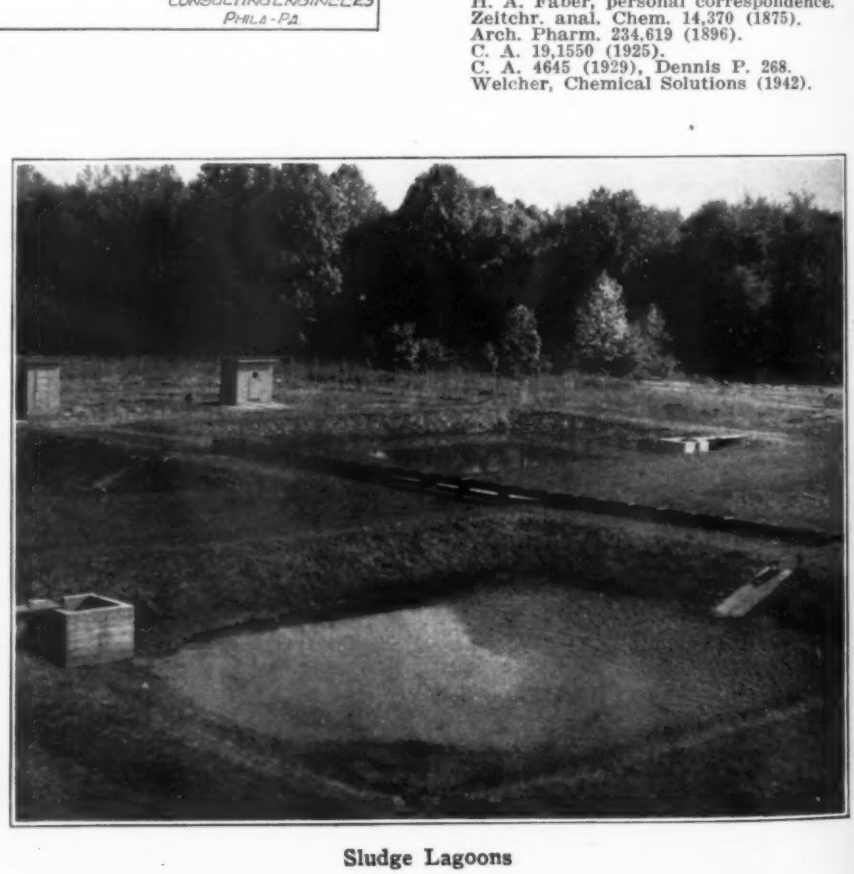

Sludge Lagoons

SEWAGE TREATMENT PLANT DESIGN

As Applied to a Wartime Industrial Waste Problem

By THOMAS M. RIDDICK*
Consulting Engineer & Chemist
NEW YORK CITY

IN 1940 the Sperry Gyroscope Co., financed by Defense Plant Corporation, began construction of a fifty-million-dollar manufacturing plant, located in the incorporated village of Lake Success, Great Neck, Long Island, N. Y. Twenty-four-hour (three-shift) operation was contemplated, with employment of a total of 18,000 persons.

Domestic sewage and industrial wastes were to be combined, and daily flows were estimated at 550,000 gal. To care for this it was necessary to construct either a new sewage treatment plant, or to connect to and enlarge some existing works. Since the Sperry site is inland, secondary treatment would have been required, necessitating extensive percolation beds for return of treated sewage to the ground. This treatment would have been costly from the standpoint of construction as well as operation, and the required land area was not readily available. A study indicated the most practical and economical solution to be as follows:

1. To construct a sewage pumping station at the Sperry site to handle both domestic and industrial wastes;

2. To run a 12 and 15-inch sewer (force and gravity) from the pumping station to the nearest municipal trunk line;

3. And to enlarge the Belgrave Sewage Treatment Plant to provide for the additional load.

The Author

The pumping station and connecting sewer lines were designed by Stone and Webster, and became the property of the Sperry Gyroscope Co. The Belgrave Plant enlargement was designed by the writer and initial costs were borne by Sperry.

All sewage from Sperry is metered. Treatment costs are proportional to the flow, and are rebated to amortize the cost of plant enlargement.

Available Plant and Proposed Revision

The original Belgrave Plant consisted of duplicate clarifiers (1.0 mgd. at 2 hours detention); a digester and glass-covered sludge drying beds with capacities for a sewage flow of 0.5 mgd.; and a head house with pump and chlorinator rooms.

When the additional Sperry load was contemplated, Belgrave (domestic) flows averaged 450,000 gpd. with a minimum night rate of 200,000 gpd. and a normal daily peak of 700,000 gpd. Both the digester and sludge beds had reached capacity loading, as was evidenced by the necessity for using filter alum to expedite sludge dewatering on the drying beds, and the occasional presence of hydrogen sulphide in sludge gas due to overcrowding and lowering of hydrogen ion concentration.

Although the anticipated average flow from Sperry was only 550,000 gpd., the pumps were rated to discharge at 1.0 mgd. To care for peak loads as well as to provide for some future growth of the District, plant capacity was established at 2.0 mgd. and provision was made for chem-

*Since preparation of this article was begun the author has become a major in the USPHS (R) and is now on overseas duty in the Near East.

Fig. 1—Remodeled Sewage Treatment Plant—Belgrave District, Long Island

ical precipitation, although this will not be employed as routine. The final proposed plant layout was as follows:

1. The construction of two manually cleaned grit chambers.
2. The installation of a Kennison Nozzle for measuring sewage flow, controlling velocity in the grit chambers and proportioning the coagulant.
3. The installation of a Comminutor.
4. The construction of a flocculation basin.
5. The construction of an additional sedimentation basin to be placed in series with the two existing units.
6. Enlargement of the existing digester from 9,000 to 18,000 c.f. and the construction of an additional unit with a capacity of 21,000 cu. ft.
7. The installation of a vacuum sludge filter.
8. The installation of a primary chlorinator for odor control.
9. And the installation of a proportioning dry feed machine for ferric sulphate.

The Belgrave Plant was originally constructed on a nine-foot fill overlying a salt marsh, and is situated on Little Neck Bay. All flow is by gravity with a 2,000-ft., 24-in. cast iron trunk outlet extending 1,500 ft. beyond the normal shore line. This large size trunk line was necessitated by minimum grade (0.08 per cent) requirements and the available loss of head through the plant was only 10 in. The remodeled plant is shown in Fig. 1, and the final flow diagram in Fig. 2.

Grit Chambers

In view of limited finances, as well as the size of the plant, grit chambers were designed for manual rather than machine cleaning. For a grit chamber to function properly, velocity must be fairly constant at about 1.0 ft. per sec. for *all* ranges of flow; it must be accessible for easy cleaning; a drop must be provided for grit catchment and collection; and the length and depth of flow should be such as to remove practically all grit retained on a 65-mesh screen, with a minimum of sludge collection.

From the fundamental equation $Q = AV$, if "V" is arbitrarily set at 1.0 (ft. per sec.) then all that is required is to have the area of the basin (in sq. ft.) equal to the flow (in cu. ft. per sec.) for all ranges of sewage discharge. Theoretically, any measuring device such as V notched and rectangular weirs, Parshall flumes, etc., could be used. From a practical standpoint, however, it is advantageous to keep the depth of flow relatively low since the length of the basin is dependent on this factor. The width of channel should be sufficiently narrow to prevent short circuiting, and to enable easy removal of grit by shoveling. A Kennison Nozzle was selected for controlling velocity, since it best serves the above requirements. In this instance, it could also be utilized for measuring sewage flow and (by means of a chronoflow transmitter) for proportioning the chemical coagulant. The nozzle also produces a minimum head loss, which was of great importance.

Although Kennison Nozzles are generally thought of as providing "straight line" flows (constant increments of discharge for constant increments of depth of flow), this is not the case. The flow curve has a sizable slope for the first 20 per cent of range, followed by two definite tangents. Fillets were designed to reduce the area of the basin proportional to the actual flow curve, for the first six inches of sewage depth. The slight curve at the intersection of the tangents was compensated for by setting the invert of the nozzle one inch below the invert of the influent sewer. This arrangement gives velocities and depth of flow shown in Table I. The grit chamber is shown in Fig. 3.

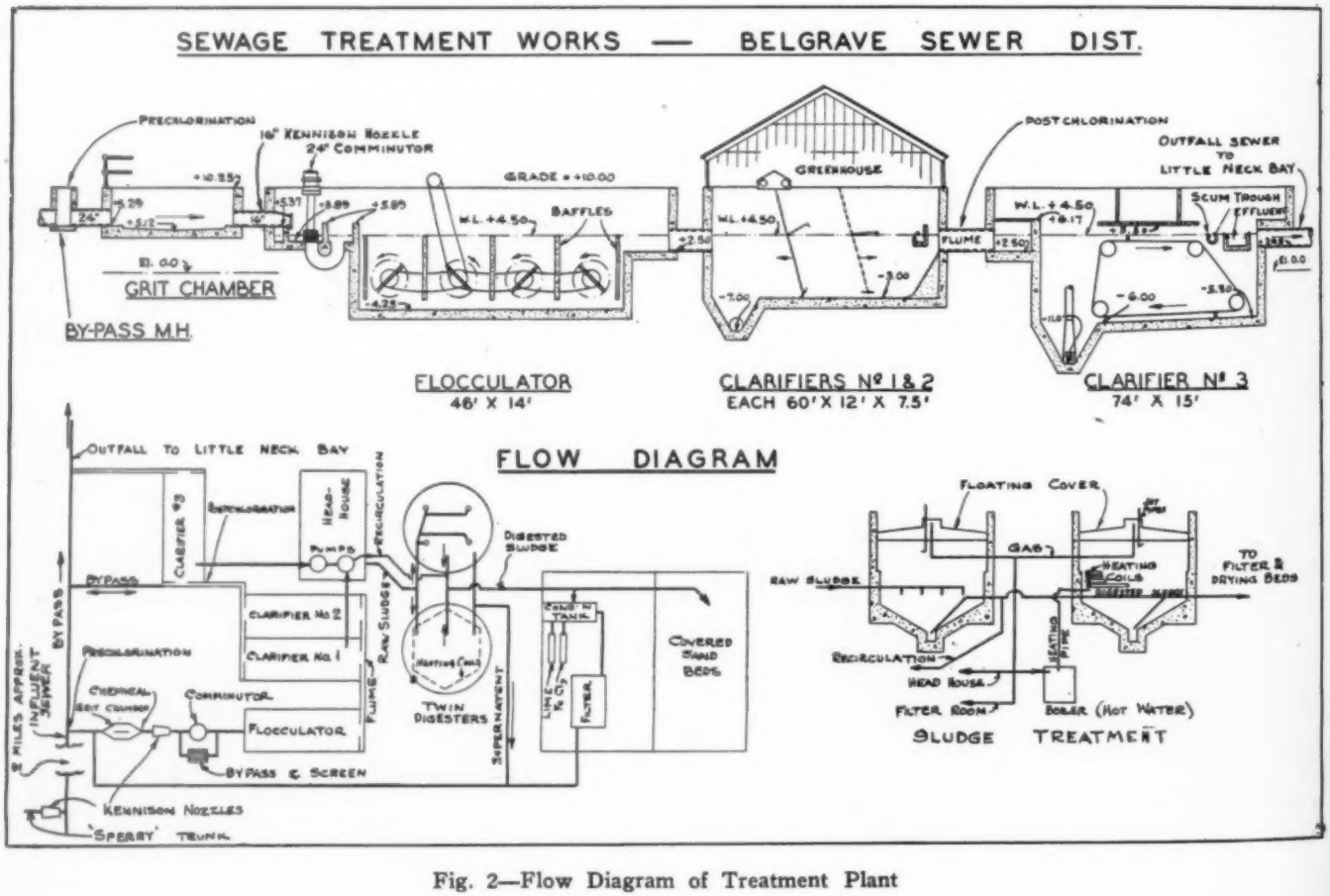

Fig. 2—Flow Diagram of Treatment Plant

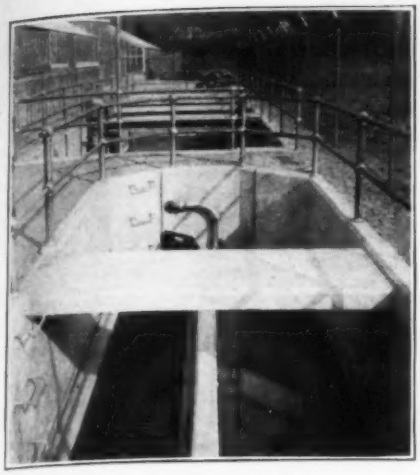

Fig. 3— Grit Chamber

(Fillets at bottom compensate for initial slope of Kennison nozzle floor—lightweight floor grating prevents short circuiting through grit drop.)

TABLE I

Relation of Depth of Flow to Velocity in Grit Chamber

Depth of Flow in Grit Chamber Inches	Depth of Flow in Nozzle Inches	Velocity Ft./Sec.	"Q" Cu. Ft./Sec.
0	1	...	...
1	2	0.85	0.17
2	3	.84	.35
3	4	.92	.60
4	5	.99	.88
5	6	1.00	1.15
6	7	1.00	1.42
7	8	1.00	1.69
8	9	1.00	1.96
9	10	1.00	2.24
10	11	1.00	2.51
11	12	1.00	2.80
12	13	1.02	3.15
13	14	1.05	3.55
14	15	1.09	3.97
15	16	1.12	4.40

The maximum (measuring) capacity of the nozzle chosen is 4.40 sec. ft. or 2.85 mgd. This is approximately 50 per cent greater than designed plant capacity and allows for peak flows. The first 4 inches of nozzle depth, giving velocities from 0.85 to 0.99 ft. per sec., are of no consequence since these flows are below the normal plant minimum.

A grit drop, varying from 2½ to 4 inches, is provided. This is overlaid with a lightweight, wide-mesh floor grating, to prevent short circuiting through the catchment area.

Each basin drains to the center and can be readily dewatered by pumping. A walkway was constructed at the midfront for placement of a wheelbarrow for removal of grit. The six-inch digester supernatant overflow line enters at the basin inlet, and the chemical feed line (ferric sulphate) discharges at the outlet end. Primary chlorination for odor control may be applied at the influent manhole, immediately preceding the grit chamber.

Flocculation Basin

The writer believes that flocculation basins are of much greater benefit than is currently conceded. They are, of course, a necessity if coagulation is to be successfully and economically employed; and they undoubtedly effect a "pseudo" coagulation or agglomeration when operated without chemicals. The advantages which have not been sufficiently stressed, however, are the "smoothing out" effects, with regard to temperature; and particularly with regard to the hourly variation in suspended solids, as well as the heavy daily load imposed by discharge of supernatant liquor during raw sludge pumping. At the Belgrave plant, hourly temperature variations are pronounced due to the half-mile of exposed cast iron trunk sewer.

The entrance end of the flocculation basin is shown in Fig. 4 and contains the Kennison Nozzle, and a 25M (24-inch) Comminutor placed at right angles to the line of flow to conserve space. The Comminutor is readily accessible for inspection, cleaning and servicing, and a flushing hydrant is located alongside for hosing. The motor is extended above high water for protection, and slide gates readily permit by-passing, if necessary.

The inlet flume to the flocculator basin is shallow (7½ in.), with a width of 24 in. All flumes and channels throughout the plant have been designed to give sufficient velocity to assure uniform distribution and prevent sedimentation, since this feature has often been overlooked. Flow to the flocculation basin is through four 12-in. ebonite slide gates and is directed downward by a cypress baffle extending to within 12 in. of the floor slab. The flocculator provides 25 minutes' detention, at 2.0 mgd., and has four agitator bays.

To provide for optimum coagulation, with or without chemicals, paddle tip velocities decrease uniformly from 1.2 ft./sec. in the first bay to 0.60 ft./sec. in the last section. To prevent stoppage and accumulation of floating scum, all baffles are equipped with adjustable weirs submerged ¾-in. below the water surface. This slight submergence is sufficient to permit passage of floating matter, but directs the major portions of flow to the bottom as intended.

Submerged chain drives were necessary, since limited space did not permit the more desirable dry well design. The effluent flume is submerged and tapered, to provide a uniform flow through the basin and prevent sedimentation in the channel proper. T beams were poured at the top of each bay for structural reasons as well as to provide walkways. Instead of using brackets for supporting the flocculator paddle shafts, piers were constructed to prevent short circuiting at the basin sides. The tops of these are sloped to prevent sludge deposits.

Sedimentation Basin

Flow from the flocculation basin is directed by tapered flumes to the two existing clarifiers, which are in

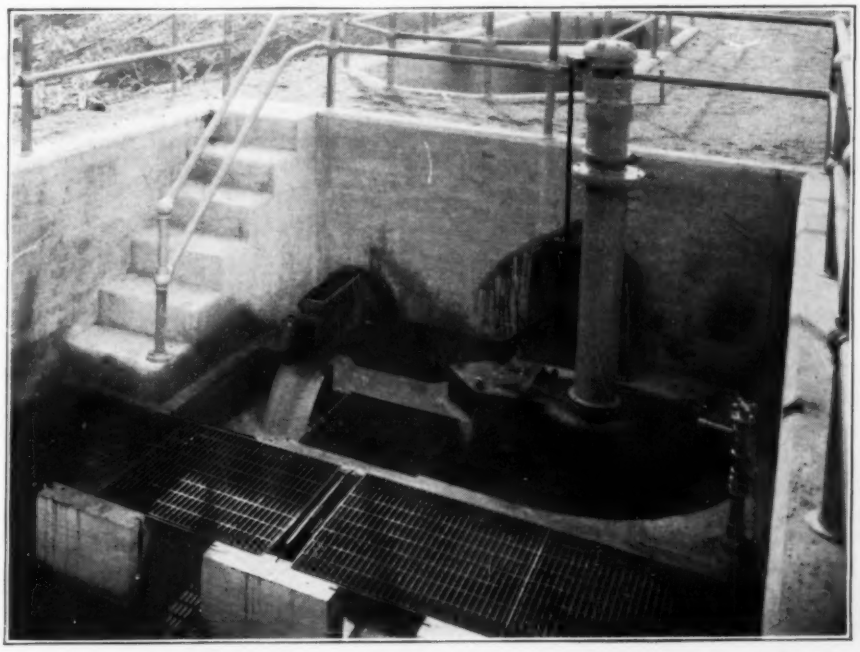

Fig. 4—Entrance End of Flocculator Basin
(Kennison Nozzle to left; Comminutor to right.)

Fig. 5—Sedimentation Basin—Roofed Over and Earth Covered Except for Short Sections at Ends

parallel. These are conventional and provide for sludge and scum removal. A vertically tapered, submerged, effluent flume directs the flow to the new sedimentation basin which is in *series* with the old clarifiers. This produces twice the velocity which would have obtained with parallel placement, and the writer firmly believes that this tends to reduce short circuiting.

In primary treatment plants, sedimentation can only effect removal of a portion of the *settleable* solids, and such settleable solids should not be confused with *total suspended* solids as determined by a Gooch crucible.

The reasons for not obtaining clarification approaching 100 per cent reduction of *settleable* solids are numerous and, although many points are open to argument, the writer believes temperature differentials to be one of the greatest deterrents to practical settling of sewage solids. This factor alone nullifies many exhaustive mathematical treatises on sedimentation, for constant temperature does not and can not exist.

(As a simple, albeit exaggerated example, collect a liter cylinder of either coagulated water or plain sewage. If the hand is placed against the outer wall of the vessel, the slight temperature differential created is sufficient to cause a "relatively" violent overturn in the liquid within a short time. The water or sewage nearest the container walls (as indicated by movement of the flocculated particles) begins to travel swiftly upwards; whereas a downward movement is exhibited by a comparable number of particles in the cooler regions towards the center of the container. These velocities far exceed those induced by the downward pull of gravity, even for the largest sewage particles.)

From a practical standpoint, the only means of overcoming the injurious effects of temperature, which cause poor sedimentation both from overturn and short circuiting, are to cover the basin with a roof slab and earth fill and, by mechanical mixing, to "even out" temperature variations inherent to sewage. Short circuiting also seems to be less in long, narrow shallow basins than in deep rectangular tanks.

The writer has often observed that water filtration plants with covered basins have twice as long filter runs as those with open clarifiers. This is due to more efficient sedimentation or, conversely, to less floc being carried on to the filters. It is also not uncommon for a water treatment plant having a flashy stream as its source of supply to have the turbid water (caused by rainfall) pass the sedimentation basins in less than one-tenth the theoretical detention period. This passage is visually evident as a "blanket" of turbid water, either at the bottom or top of the basin—at the bottom more frequently.

At the Belgrave plant, the writer has seen black cesspool tank wastes pass through a clarifier in 10 to 15 minutes; and at most plants the supernatant liquor from digesters, during raw sludge pumpage, passes across the surface of the basin within this same period of time.

The Belgrave sedimentation basin is shown in Fig. 5. The inlet flume discharges at the center, and the distributing flume is tapered to prevent sedimentation and provide uniform distribution through the four inlets. A tilted cypress baffle is placed in front of the inlets, and this has an adjustable weir set ¾-in. below flow level to permit passage of floating scum. The basin is relatively long (74 ft.), as compared with width (15 ft.) and depth (10¾ ft.). Hoppers are exceptionally steep and little spading is required. When necessary, a slicing bar can be readily used without removal of gratings, since the outline of the walkways is the same as the hoppers.

To minimize overturn and short circuiting, the basin has a roof slab with four feet of earth cover. The slab was designed flat—without beams or girders to pocket dead air and produce condensation and malodors. Scum is removed by a 10-inch tilting collector pipe, shown in Fig. 6 with the porcelain plate effluent weir beyond. Since the basin operates in series rather than parallel with the two existing clarifiers, velocities through the basin are naturally twice those normally obtained. Dye tests have shown that this factor increases rather than decreases the efficiency of sedimentation.

Sludge Piping

Six-inch sludge piping was employed, using 8-inch sludge shoes with reducers. Most sludge lines are run to tank level with a removable valve box cover for rodding. This necessitates a floor slab across the hopper centers, which is an obstruction from the standpoint of hopper slicing. This was obviated by running piping the simplest and most direct route to the sludge manhole and providing flushing lines on either side of the control valves.

It is always desirable to pump a minimum amount of raw sludge or, in other words, to quit pumping as soon as the sludge runs thin. Excessive pumping requires more sludge gas for heating (few plants in the northern states have any excess in the winter months) and produces excessive return supernatant, which places an unwarrantably heavy load on the clarifiers.

To facilitate operation, a sludge and scum manhole was located adjacent to the hoppers with all valves within easy reach. The "heaviness" of sludge can always be visually judged and valves closed when each hopper is emptied. A push button station for the raw sludge pump motor is also located at the manhole, so that the pump may be started or stopped without delay.

Digesters

Since the original digester was designed for 0.50 mgd. sewage flow, it was necessary to quadruple this capacity. The existing structure had a Hewett pre-stressed dome placed at ground elevation with a Hardinge stirring mechanism. This roof slab was demolished, walls were extended 11¼ ft. above ground elevation and a new digester was constructed alongside. The two units were connected by a 14-foot operating gallery.

Piping was simplified, all valves being accessible from a single operating floor without resorting to chain wheels or elevated platforms. Raw sludge lines (6-inch) were run

Fig. 6—Effluent Weirs—White Porcelain Plates Shaped to Produce Discharge in a Thin Film

to points just below the landing ledges for the floating covers. From these, four 4-inch valved lines extend to the four quadrants of each tank. At the terminus, all lines have a 90° turned down flange and flare elbow. It does not seem reasonable that a single outlet can properly distribute raw, semi-septic sludge to a 30-foot diameter digester. Furthermore, the sludge in the tank at the terminus of the line must always be the least digested; whereas it is desirable to add raw sludge to that well digested to take advantage of the seeding and buffering effects afforded by the latter. In most digesters there is a blanket of scum and poorly digested sludge in the top section. This will vary in depth from a few inches to four or five feet. It has little or no seeding or buffering value. It therefore seems illogical to have raw sludge lines turned up into or towards this area. It likewise seems illogical to terminate a straight run of pipe at the center of a digester, for there will be the tendency for raw sludge to accumulate at the far side.

The writer is convinced that raw sludge lines should be turned downward, and it is reasonable to suppose that alternating points of discharge daily will result in raw sludge coming in contact with much better digested material than would be possible with a single inlet. At the Belgrave plant these lines are supported by 6-inch I-beams, which also proved to be of great value in supporting the floating cover during erection and for securely anchoring the central gas collector line.

A false floor was placed just below the bottom valves (raw and digested sludge), giving a maximum distance from the floor to the top valved supernatant line of only eight feet, which is within easy reach for operation of plug valve handles. The major portion of piping, which often clutters a control room, is located below the upper floor, and this is readily accessible by means of grating covered manholes. This lower section is well ventilated to prevent condensation, and is lighted by four explosion-proof lamps. A sump provides for any possible leakage.

Supernatant Handling

Much has been written on the pros and cons of sludge digestion with heated or unheated secondary tanks; but little has been said of the supernatant liquor, which, at each raw sludge pumping, badly fouls the incoming raw sewage and places quite a load on the plant in terms of both suspended and dissolved solids. In primary treatment, the latter cannot possibly be removed.

The writer's views are open to question, but operation (at least for the time being) will be as follows: Digester No. 1 will be heated to 90° F., and No. 2 to as high a temperature (not to exceed 90°) as gas production will permit. Raw sludge pumpage will be daily rotated to the four quadrant outlets. The cover of Digester No. 1 will be maintained at an elevation several feet above that of No. 2, and the supernatant from No. 1 will be daily bypassed to No. 2. (This is accomplished by simply opening the bypass from the supernatant to the digested sludge lines after pumping raw sludge.)

This operation causes an overflow of *clarified* supernatant from Digester No. 2, which experience has shown to contain only about one-tenth the solids content of the supernatant from the primary digester. This procedure permits No. 1 to be "loaded to the hilt," with no regard for the solids content of the primary supernatant overflow, and this loading can be about twice that normally employed. Sludge from Digester No. 1 will consequently be heavier and of less volume per pound of dried solids.

Heating coils are ample and extend from a point just below the landing ledge to within three feet of the bottom. Hopper bottoms are steeply sloped to prevent dead areas near the tank circumference; and the digested sludge line is perpendicular to enable uniform withdrawal from all areas rather than pulling from the far side, which must occur when a single line is laid along the floor from the center to the walls.

Many thermal and electrical controls were omitted in the heating layout. Oil-filled wells (1¼-inch pipe lines) extend from the operating floor 10 feet into the tank, and into these are placed capsules connected to dial indicating thermometers.

Digested sludge temperatures change so slowly that recording instruments are unnecessary. Automatic thermoelectric control was eliminated for hot water circulation, since these are generally a source of operating and maintenance trouble. Circulation pumps are manually controlled and will operate from 8 to 24 hours daily as required. The only thermostatic control is that on the boiler proper for maintaining correct water temperatures for the heating coils.

Meters, flame traps, waste gas burners, etc., are conventional. The

Fig. 7—Digesters—Showing Staff Gage Attached to Gas Riser Pipe

Fig. 8—Ferric Sulfate Feeder—Chronoflo Transmitter Is Mounted on Top of Transite Flow Tube at Right

control house is ventilated by louvres and a penthouse exhaust is located in the roof for use when required. Heating coils were designed to care for normal heat loss and raising the temperature of 1600 cu. ft. of sludge from 50° to 90° F. daily.

The exterior of the digesters was faced with brick and a ½-inch air insulation space was provided. On the bottom course a ¼-inch open joint was left each seventh brick for removal of condensation.

Floating covers are conventional except that three jetter pipes, rather than one, were installed. These consist of 2-inch piping with 2x1-inch reducers turned downward, horizontal and at a 45° angle, respectively.

Porcelain staff gages, calibrated in feet and tenths, are attached vertically to the digester gas risers. One of these is shown in Fig. 7. A horizontal wire across the diameter of the tank enables easy reading of gage heights from the control-room office. A rise or lowering of one foot represents a raw sludge pumpage or withdrawal of 708 cu. ft. This is the only accurate means of measuring raw sludge pumpage, as computations based on the number of pump strokes are liable to considerable error.

Vacuum Filter Installation

The installation of a vacuum filter, rather than additional sludge beds, was indicated by the necessity for using piling under all structures, or carrying all foundations 20 ft. below grade. The existing sludge beds had reached their capacity, so a one-third section of the glassover was housed for a filter room. The general installation is conventional but considerable credit is due to the Eimco Corporation for their excellent cooperation and engineering service.

Digested sludge is piped to the conditioning tank by gravity, though a Chicago Scru-peller Pump is also placed on the line for use when the floating covers are at their lowest level; or if the low gravity head should result in clogging. The mixing tank has three sets of agitators (or flocculators), and tank walls extend 6 inches above the overflow weir of the filter. A constant level is maintained in the tank (and in the filter) by a float controlled butterfly valve placed on the sludge line in the tank. Ferric chloride is pumped from a 60-gal. crock with a Ferro-feeder, and a W & T lime feeder discharges direct to a small centrifugal pump which boosts the milk of lime to the mixing tank. Dewatered sludge is discharged to a belt conveyor which extends outside the building for dumping into a truck.

Chemical Precipitation

The uncertainty as to quantity of sewage, and nature and volume of trade wastes from Sperry, dictated the installation of chemical feed equipment. This consists of a specially designed W & T ferric sulphate feeder (Fig. 8). The rate of feed is proportional to the rate of sewage flow, being controlled by a BIF Chronoflo transmitter, mounted on the Kennison nozzle float tube. Water is accurately measured by an S & K Rotameter.

The plant was operated with ferric sulphate for a period of three weeks, and considerable improvement over plain sedimentation was noted. Chemical precipitation is not required at this time, however, since the effluent (without chemicals) is well below the Interstate Sanitation Commission's requirements for discharge into class A waters.

Plant design was begun in the Spring of 1942 and the contractor commenced work in November of that year. The job was completed in the Fall of 1943 and the plant has successfully operated since that time. Gas production and heat transfer were such that the primary digester was brought to a temperature of 90° in less than one month from filling.

The writer wishes to commend the work by the general contractor, the Sam Tarascio Company, under the direction of Mr. Walter Jackson; and to acknowledge the excellent cooperation of the Belgrave Board of Sewer Commissioners, Sperry Company and Defense Plants Corporation.

Speaking of Tastes

(Everybody to His Own Likings)

Tree roots were clogging the sewers of Ritzville, Wash., and Earl Conwell, Sup't. of Water and Sewers was at his wit's end to identify the specific trees causing the trouble, with the idea of removing only the offending trees and sparing the "innocents."

Councilman Lundgren came forward with the following suggestion as a certain way out—"Just taste the roots—you know that you can tell any type of tree just by tasting the roots."

It is reliably reported that the offending trees of Ritzville are still unidentified and the town-council has O.K.'d the purchase of a first-class sewer cleaning outfit and the best type of root-cutting tools obtainable. Sup't Conwell is perfectly willing to remain ignorant when it comes to tree identification by the root-tasting route.

New Uses for Filter Alum

The following item appearing in the Garden Section of the N. Y. *Herald Tribune* should interest water works men who may have the Japanese beetle or the rabbit problem, or those who may have a surplus of filter alum next summer to offer those consumers who have been "living right."

Sulphate Checks Rabbits

"Aluminum sulphate, regarded very highly as a non-poisonous Japanese beetle repellent, also is valuable in keeping rabbits away from the Victory Garden. Two tablespoonfuls of aluminum sulphate and one tablespoonful of soap or some other spreader dissolved in a gallon of water to be applied as a fine spray to the vegetation attractive to rabbits will keep them away."

P. S.—If any of our readers have already had experience with sulphate of alumina in beetle or rabbit control or other unique adaptation, we will appreciate hearing more about such uses.

WASTE TREATMENT PAYS IN A PAPER MILL*

Heat Economy Effected by White Water Recovery and Re-use

By HARRY W. GEHM
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NEW YORK, N. Y.

HEAT recovery resulting from the re-use of clarified mill power water has received much less attention than the savings resulting from fiber recovery. Such savings, however, can be substantial in a mill where the process necessitates heating a large volume of water to a considerable degree. Re-use of a large percentage of such water hinges on an efficient fiber recovery system which will remove all but the finest of dispersed matter.

Another factor on which such operation depends is the ratio of water returned and water discharged, as sufficient water must leave the system to prevent accumulation of "fines" and dissolved material which would sooner or later affect the manufacturing process.

The mill supplying the data presented herein produces an average of 239 tons of various types of container board daily. The recovery system consists of a mechanically cleaned clarifier providing 30 minutes detention time, followed by a Laughlin filter in which the water passes through a six-inch bed of fine sand. Automatic washing is accomplished by a traveling device which does not interrupt operation. The filter effluent flows to a diversion box which divides the flow, an average of 76 per cent being returned to the mill and 24 per cent discharged to the sewer. An average 2.3 mgd. is handled by these units with a recovery of about six tons of solids each day.

Mill Makeup Water

The temperature of the mill water was maintained at about 120° F. throughout the year, with live steam. Makeup water was obtained from a surface supply and its temperature varied seasonally as indicated in Fig. 1. This makeup water dropped as low as 39° F. during the winter months and rose to a high of 74° F. during the summer. Temperature drop of the mill water on passage through the recovery unit for each month in the year is shown in Fig. 2.

*Presented before the Water, Sewage and Sanitation Division of the Amer. Chem. Soc. Meeting in New York, Sept., 1944. Released for publication in *Water Works and Sewerage*.

The Author

During the summer months the heat loss through this unit was negligible, but during cold weather temperature drops as high as 35 degrees were recorded. When applied to over two million gallons of water this represents a considerable amount of heat lost. Theoretical heat requirement in terms of million Btu. per ton of product were calculated for this mill operating with and without the recovery system for each month in the year from temperature data collected over a two-year period. These data, presented in Fig. 3, represent the actual heating load irrespective of generating and exchanging efficiencies. Shown also in Fig. 3 is the heat conserved for each month. This represents the difference in new heat input required by the two methods of operation and unquestionably are fairly accurate figures, having been based on actual temperature differences.

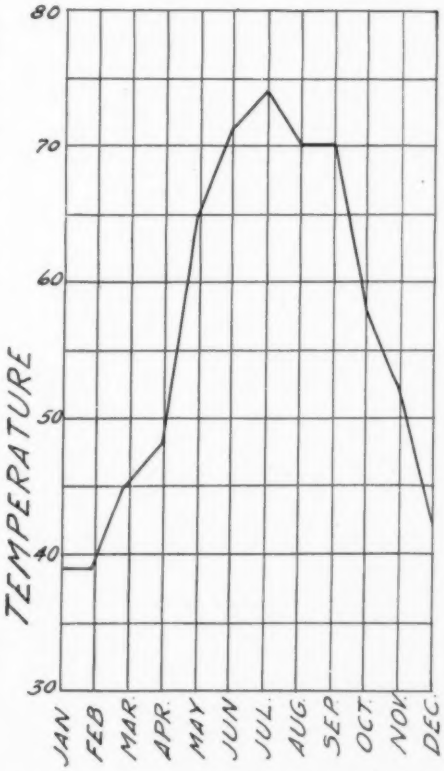


Fig. 1. Make-up Water Temperatures

To put these figures on a fuel basis it was necessary to apply generation and exchange efficiencies in the calculation. Accurate efficiency values as well as fuel data were not obtained for the mill studied because of a number of complicating factors such as the use of culm of variable heat value as fuel. Hence a conservative efficiency value of 75 per cent, a fuel Btu. value of 15,000 and a prewar price of $4.50 per ton were used in the following calculations.

Value of Recovered Heat

Examination of the curves plotted in Fig. 4 reveals that return of mill water resulted in the conservation of from 230 to 412 pounds of coal per ton of board produced, the quantity depending on the temperature of the makeup water. In terms of monetary saving, 50 to 93 cents per ton of product resulted from use of the system. The annual average recovery was 74 cents per ton of product.

On the basis of total production the mill operating this process realized a daily average fuel saving of $177. As the average daily flow entering the recovery plant was 2.304 mgd., fuel economy alone provided almost $76 per mil. gal. for plant operation once the cost of the installation was covered. Experience with this type of treatment applied to a number of wastes has demonstrated the fact that this amount is adequate to cover operating costs, even when continuous attendance is provided. It has been calculated that in thirty-three months the cost of the plant and its operation for that period was recovered by fiber and heat recov-

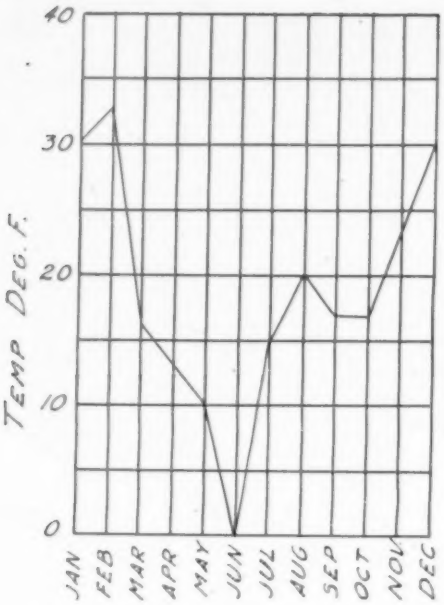


Fig. 2. Temperature Drop Through Plant

ery and that since that time operation of the plant has actually been profitable.

Other Vaiues of Recovery System

Another case which is of importance in some instances in regard to such processes is the mill whose boiler plant is close to the limit of its steam output during the cold months and where an extension of boiler capacity is indicated. Considerable study of the alternate installation of a recovery system whereby the mill water can be re-used is most certainly indicated.

Water conservation is also a factor frequently involved. A number of instances are on record where mills have overcome repeated critical low water supply troubles during dry seasons by re-using considerable quantities of the white water.

Admission of such wastes to municipal sewage systems to provide further treatment depends usually on the volume and character of the waste. In many cases both the solids content and volume of white waters are too great for economical handling by sewage plants. Marked reduction, however, in solids content and volume, such as provided by the type of pre-treatment described herein, would allow their admission to sewage systems.

Standards of Effluent Pollution Load

The operation of systems returning water leads to a question regarding the

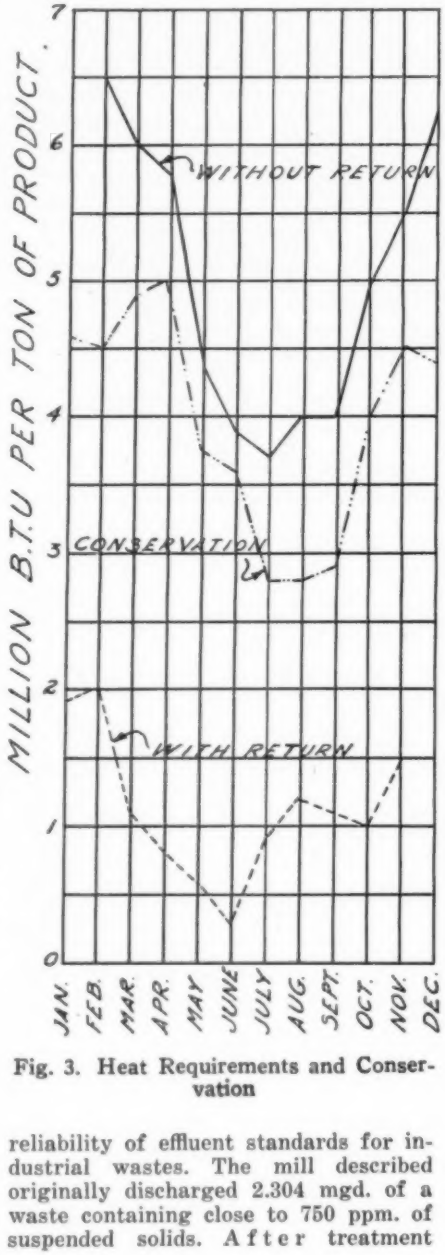


Fig. 3. Heat Requirements and Conservation

reliability of effluent standards for industrial wastes. The mill described originally discharged 2.304 mgd. of a waste containing close to 750 ppm. of suspended solids. After treatment 0.550 mgd. of a waste containing 140 ppm. of suspended solids was discharged. Had the original rate of discharge continued, an actual suspended solids reduction to only 58 ppm. would have been realized. It is evident, therefore, that in such cases attempts to judge the reduction in pollution by concentration of the waste without regard to volume are misleading.

This discrepancy could be overcome by setting up standards based on total permissible pollutional load in respect to conditions in the receiving stream. Such a figure would also lend itself to seasonal adjustment as the quantity of dilution water, oxygen available, and the rapidity of self-purification varied. Hence, the matter of stream capacity for handling wastes could be utilized to the highest degree. Likewise, satisfactory treatment could be more closely defined, and industries would have a better conception of whether or not a proposed process would meet requirements.

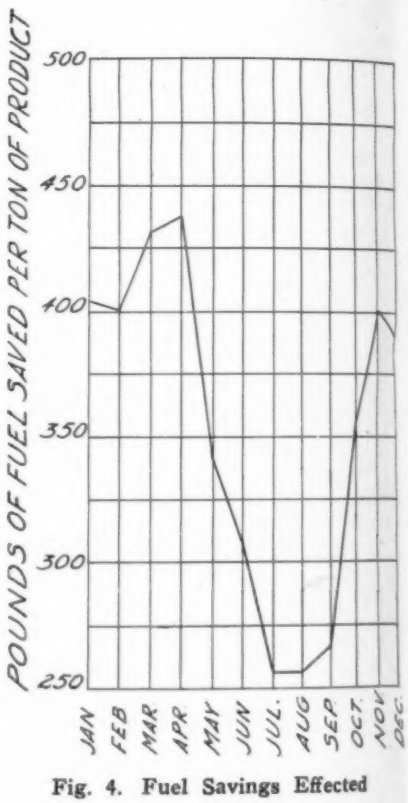


Fig. 4. Fuel Savings Effected

Danvers Also Has Two Kinds of Sewers

Roger Esty, Supt. of Water and Sewers for Danvers, Mass., having noted that *Water Works and Sewerage* has been rather concerned recently over the question of how to determine when *sewers* are not *sewers* and when *sewers* are *sewers*, sent in the following newspaper clipping from Danvers.

D. W. A. Sewers

There will be an all day meeting of the D. W. A. Sewers at the Red Cross rooms tomorrow. The rooms are open from 10 A. M. until 4 P. M. All are invited. There is still an urgent call for more sewers.

Yes, this is English as she is wrote —pity the poor furriner who wants to know when is a sewer not a sewer, but a *sewer*.

Just an Advertising Man!

Glorifying pink chemises
Eulogizing smelly cheeses,
Deifying rubber tires,
Sanctifying plumbers' pliers,
Accolading rubber panties,
Serenading flappers' scanties,
Sermonizing on throat mixtures;
Rhapsodizing hotel fixtures,
Some call us the new town criers,
Others call us cock-eyed liars.
—I Donohoo in Advertising News.

WATER AND SEWAGE PATENTS

(OF RECENT ISSUE)

WATER PATENTS

Method of and Apparatus for Banding Tanks. John Maurice Crom, Washington, D. C. U. S. 2,364,696; Dec. 12, 1944; (Appl. 2-2-44). A traction driven wheeled vehicle mounted to wind continuous wire reinforcing around tanks.

Water Treating Apparatus. Merrill P. Robinson (to Worthington Pump and Mach. Corp., Harrison, N. J.). U. S. 2,365,293; Dec. 19, 1944; (Appl. 4-25-41). A water treatment tank comprising an inlet at the bottom for both water and water treatment chemicals with means for causing recirculation of some of the water and chemicals together with slurry from precipitation, and means for controlling and returning some of clarified water to the influent to maintain a constant rate of flow through the tank irrespective of the quantity of treated water withdrawn.

Fluid Treating Apparatus. Wentworth M. Pratt, Los Angeles, Cal.; U. S. 2,365,492; Dec. 19, 1944; (Appl. 6-23-42). A vessel for holding fluid treating materials.

Means for Cleaning Well Screens. Norris E. Gunderson (to Layne-Northern Co. Inc., Mishawaka, Ind.). U. S. 2,365,872; Dec. 26, 1944; (Appl. 6-15-42). A device to be lowered into a well with means for sealing off sections of the well screen and backflushing that section with pressure.

Production of Potable Water from Saline Solutions. Reginald S. Dean (to the Govt. of the U. S.). U. S. 2,366,184; Jan. 2, 1945; (Appl. 3-22-1944). A method for reducing salinity of water by passing saline solution in one direction over a semi-permeable membrane while passing a more dilute solution in the opposite direction on the other side of the membrane.

Liquid Treating Apparatus. William Brewster Gurney (to Permutit Co., New York). U. S. 2,366,898; Jan. 9, 1945; (Appl. 12-16-39). A combination mixing, coagulating and settling tank employing upflow principle and passage of water through slurry.

Apparatus for Clarifying Liquids. Harold H. Harms and Avery S. Harlan (to Honan-Crane Corp., Lebanon, Ind.). U. S. 2,366,903; Jan. 9, 1945; (Appl. 5-15-42). A pressure filter screen apparatus with a means for removing the foreign matter removed on the screen by compressed air.

Decarbonization of Water. James D. Walker (to Amer. Well Works, Aurora, Ill.). U. S. 2,366,945; Jan. 9, 1945; (Appl. 5-11-40). Means for removing CO_2 from water by distributing it through a rotary distributor over a granular bed, and recirculating.

Fluid Meter. William M. Ahlstrom, Mentor, Richard J. Tischler and Frank H. Parsons, Fairport Harbor, Ohio. U. S. 2,367,176; Jan. 16, 1945; (Appl. 8-5-38). A venturi orifice and bypass arrangement.

Water Rectification. Marc Lurie, Indianapolis, Ind. U. S. 2,367,228; Jan. 16, 1945; (Appl. 12-15-41). A method of rectifying water to prevent the deposition of lime therefrom by passing it through a checker board arrangement of slowly soluble lime blocks.

Liquid Treating Apparatus. Albert Eaton, Garden City, L. I. U. S. 2,367,851; Jan. 23, 1945; (Appl. 2-24-41). A liquid treating apparatus, with treating tank, heater therefor, filter and means for discharging water from treating tank through filter.

Water Purification System. James D. Walker (to American Well Works, Aurora, Ill.). U. S. 2,368,055; Jan. 23, 1945; (Appl. 3-27-40). A system for removing compounds causing tastes and odors in water by first treating the water in an aeration tank and mixing it with aerobic flocs of bacteria and the like which reduce the foreign matter causing the taste and odor before the water is discharged into a flocculating and coagulating basin followed by settling and filtration.

SEWAGE PATENTS

Sewage Clarifier. Walter H. Green (to Infilco, Inc., Chicago, Ill.). U. S. 2,364,023; Nov. 28, 1944; (Appl. 7-24-41). A tank comprising two parts, with the sewage introduced into the bottom of the center compartment and flowed upward past mixing paddles to an expanding section, and then downward to the outside annular ring section where it flows upward with sludge settling out as the liquid rises to the effluent weir.

Sewage Treatment. Ewald A. Kamp, (to Graver Tank and Mfg. Co., Inc.). U. S. 2,364,298; Dec. 5, 1944; (Appl. 12-20-41). A trickling filter with deep narrow channel adjacent to outer edge wherein raw sewage is aerated before being discharged onto the trickling filter media.

Septic Tank. William M. Piatt, Durham, N. C. U. S. 2,364,472; (Appl. 7-18-39). A septic tank comprising two stages, with each stage a two compartment tank and arrangements for removal of digestion gases without disturbing the tank contents.

Filter Distributor Seal. Walter J. Hughes (to Infilco, Inc.). U. S. 2,365,272; Dec. 19, 1944; (Appl. 9-17-43). A seal and bearing for a rotary distributor system.

Apparatus for the Removal of Water, Liquors, or Other Liquids from Soaked Masses of Fibrous Materials. Fritz Schumaher (to Amer. Voith Contact Co., Inc., New York). U. S. 2,365,658; Dec. 19, 1944; (Appl. 3-14-41). A filter drum over which a cloth moves and rollers press water to inside of drum.

Process of Treatment of Sewage. Scott E. Linsley, St. Paul, Minn. (U. S. 2,365,889; Dec. 26, 1945 (Appl. 2-14-41). A process control method of adding coagulating salts to sewage sludge for dewatering wherein the amount of the salt or coagulant added is determined from analysis of the sludge and application of a formula.

Extraction of Iron from Pickle Liquor or Solutions containing Iron Salts. Stephen F. Urban, Chicago, Ill. U. S. 2,366,298; Jan. 2, 1945; (Appl. 4-19-41). An electrolytic method for maintaining the composition of the pickling bath constant and removing the iron therefrom.

Unit for Drainage Systems. Maurice R. Gutman, Lynbrook, N. Y. U. S. 2,366,522; Jan. 2, 1945; (Appl. 11-10-42). A shield of semi-circular shape resting on an absorption bed with the drainage conductor carried at the upper inner surface of the shield and spilling its contents therefrom.

System and Method for Treating Sewage or Other Waste Material. Max Levine (to Iowa State College Research Foundation, Ames, Iowa). U. S. 2,366,917; Jan. 9, 1945; (Appl. 2-26-28). A two stage trickling filter system with settling tanks following both stages and recirculation from the intermediate and final clarifying tanks to the primary settling tank.

Septic Tank. George E. Evans and Irwin Gutman, Lynbrook, N. Y. U. S. 2,367,270; Jan. 16, 1945; (Appl. 2-16-42). Septic tank structure comprising a plurality of chambers generally rectangular in form.

These patent abstracts being brief do not necessarily cover the entire scope of the invention described. If the reader becomes especially interested in any of these patents he should obtain printed copies of the complete patent, at 10 cents each, from the Commissioner of Patents, Washington 25, D. C.

The Editor's Comments

A National Water Standard

IN the new U. S. Public Health Service Drinking Water Standards the definition of a public water supply system does not stop at the limits of ownership and jurisdiction of the water utility—namely, to the water taker's property line—but, embraces also the piping systems on the premises of the taker all the way through to the *"free flowing outlets of the ultimate consumer."* Further the Standards state that "the water supply system *in all its parts* shall be free from sanitary defects and health hazards and shall be maintained *at all times* in proper sanitary condition."

Water supply authorities have accepted the new Federal Drinking Water Standards as an advance and a model for attainment. However, they have been unwilling to accept responsibility for sanitary conditions on the customer's premises. It is this part of the Standards to which the Board of Directors of the Am. Water Works Association have voiced vehement objection to the Public Health Service. It is quite evident why; water supply authorities have absolutely no legal jurisdiction over piping systems on customer's properties.

Having put this situation squarely up to the Public Health Service, representatives of the A.W.W.A. (aided possibly by objections to the wording of the Standards from State Sanitary Engineers and others) have been instrumental in securing from the Public Health Service an interpretative letter addressed to all State Health Authorities. Dated Sept. 1, 1944, and known as Circular Letter No. 85.

Space does not permit any detailed comment on the contents of Circular Letter No. 85, except to say that it proves sufficient to permit certification of supplies which for the present do not meet the standard requirement of freedom from pollution hazards through cross-connections or plumbing defects on customer properties. The Board of Directors of A.W.W.A. have the feeling that the Standards, in themselves, should be revised sufficiently to be workable as they stand. The idea is that the Standards should be applicable from the standpoint of practical attainments of the present, as well as serving as models for attainments of the future. Furthermore, the intent of the A.W.W.A. is to officially adopt a workable U.S.P.H.S. Standard, if developed, as the National Standard for Drinking Water, whereas the U.S.P.H.S. Standard legally applied only to public supplies used in interstate carriers.

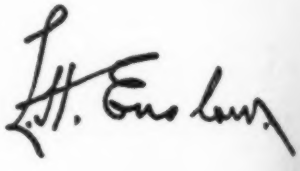
In the above direction progress is being made. The U. S. Public Health Service has taken a laudible, open minded attitude toward the urge of A.W.W.A. for revision of the Standards. In consequence, certain revisions are now in the process of formulation, and one can confidently expect the development of a workable Standard which will become the National Standard, officially adopted by the A.W.W.A. The Public Health Service will not have to delete those sections which all conscientious water purveyors and health authorities realize to be ideals of attainment. For the purpose of having the Standards endorsed by A.W.W.A. for American water supply as a whole, it appears only necessary to insert into the present Standards clauses which will limit the responsibility of the water utility as only to the customer's property line, or in any event, not beyond the water meter. At the same time the responsibility for interior plumbing conditions may well be stipulated as that of local and state health departments and plumbing inspection or building departments. However, in the case of commercial cross-connections between private and public supply systems, the water utility should assume a moral responsibility in so far as making every attempt to locate all such connections; it should secure needed corrections, and cooperate in supervision over connections of such magnitude to the end of obtaining systematic inspections, tests and maintenance of protective devices thereon.

In the above direction, John H. Murdoch, Principal Attorney for the Am. Water Works and Electric Co., has well said in a paper read before A.W.W.A. (published in our August, 1944 issue) the following, after warning water utility managers not to accept any outright responsibility for piping conditions on customer premises. Mr. Murdock, who is also President of the Pennsylvania Water Works Ass'n. of many years service, voices the opinion—"There *is* a moral responsibility on the water operator to use his influence to bring about better plumbing practices. There is a *moral* responsibility to take necessary actions, within his rights and abilities, to remove from the system any and all hazard creating sanitary defects which he knows to exist or *should* know to exist.

In a yet unpublished paper, presented only recently before the New England Water Works Association, Warren J. Scott, Director of Sanitary Engineering, Conn. State Dept. of Health, commented on the need for eliminating cross-connection and back-syphonage hazards. After a clean cut analysis of the problem and its most likely solution, Mr. Scott advocates that surveys and correctives might best be obtained through the efforts of a local committee consisting of the city health officer, the manager of the water utility, the director of public works or the city engineer, and the plumbing or building inspector. He advocates assistance in these programs by the State Dep't. of Health to the greatest permissible degree, other than in regular and continuing local inspections. Mr. Scott, too, voiced the opinion that it is the water utility's business to display interest and cooperate in working out plans of correction, even though there is no legal responsibility involved.

What can and has been done in an effort by one important water utility to correct hazards to water quality at the taker's end of the line is revealed in the featured article of this issue by Ray F. Goudey, Chief Sanitary Engineer, Bureau of Water, Los Angeles.

What the water quality standards of the future can bring about is, therefore, already being demonstrated. The attitude of men like John Murdoch, an attorney and operator, and Warren Scott, as state health authority, is both stimulating and reassuring. Now, if the U. S. Public Health Service will come through with a revised Drinking Water Standard, looking to the ideals of tomorrow but written so as to meet those practical aspects as they must be met today, and defining the limits of responsibility on the important basis of legality as well as from the moral viewpoint, we shall soon have a National Water Quality Standard. And a new page will have been added to the history of water supply sanitation.



MEETINGS SCHEDULED:

IMPORTANT

It will be noted that a number of the conferences listed below have been cancelled as the result of the directive issued by the Federal War Committee on Conventions.

Meetings, conferences, short schools, which will require hotel rooms or sleeping car accommodations for no more than 50 persons are considered as local or sectional meetings, and a permit to hold such meetings is not required. Therefore many conferences and short schools can be held without filing an application. Note the NEWWA and Maine meetings reported in this issue, as examples. Also note that the Canadian Section Meeting is to be held with hotel reservations limited to 50.

Mar. 15—BOSTON, MASS. (Hotel Statler).
New England Water Works Association. Secretary, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Mar. 15-16—LAFAYETTE, IND.
Indiana Section A.W.W.A. (Cancelled).

Mar. 19-21
Southeastern Section A.W.W.A. (Cancelled)

Mar. 19-21—TORONTO, ONT. (Hotel Royal York).
Canadian Section A.W.W.A. Sec'y-Treas., Dr. A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

Mar. 22-23—TRENTON, N. J.
New Jersey Sewage Works Ass'n (Cancelled).

Mar. 29-31—SARASOTA, FLA.
Florida Sewage Works Ass'n. (Cancelled)

Apr. 5-6—COLUMBUS, OHIO.
Ohio Section A.W.W.A. (Cancelled).

Apr. 12-13—LEWISTON, MONT. (Hotel Burke).
Montana Sewage Works Ass'n (First Annual Meeting). Sec'y-Treas., Herbert B. Foote, State Board of Health, Helena, Mont.

Apr. 13-14—LEWISTON, MONT. (Hotel Burke).
Montana Section A.W.W.A. Sec'y, H. B. Foote, Dir. Div. San. Eng., State Board of Health, Helena, Mont.

Apr. 19-20—ELMIRA, N. Y.
New York Section A.W.W.A. (Cancelled)

May 2—BOSTON, MASS.
New England Sewage Works Ass'n (Spring Meeting). Sec'y-Treas., LeRoy W. VanKleeck, State Dept. of Health, Hartford, Conn. (In our Feb. issue erroneously marked "Indefinitely postponed.")

May 7-11—ST. LOUIS, MO.
American Water Works Ass'n. (Annual Conference) (Cancelled). However, there will be held a meeting of the Board of Directors for the purpose of transacting the essential business of the Association at some centrally located point—the place and date to be announced later.—Ed.

PERFECT THREADS
with surprising ease and speed

with this self-contained RIDGID No. 65R

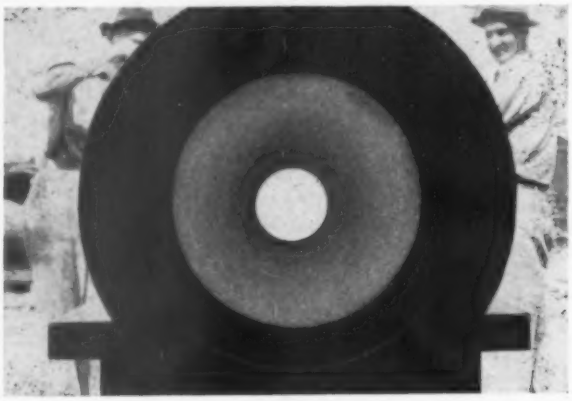
● No wonder the popularity of this threader has spread widely. The speed and ease with which it cuts clean perfect threads on 1" to 2" pipe are reasons enough. One set of high speed steel chasers threads all 4 sizes—and they set to pipe size in 10 seconds! Workholder sets instantly! You'll like other work-saver features of this rugged steel-and-malleable die stock—it pays you to try the self-contained No. 65R at your Supply House.

No. 65R stands up handily when you want it to.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY · ELYRIA, OHIO, U. S. A.

Internal Corrosion and Tuberculation which increase pumping costs

ABSENT FROM MONO-CAST ENAMELINE PIPE



Photograph: Looking through Enameline Mono-Cast Pipe immediately after cement lining but before asphalt seal coat has been applied.

Experience has proven that internal corrosion and tuberculation are eliminated by the use of Mono-Cast Enameline Pipe. The value of "C" for new Enameline Pipe is 140 or more and since Enameline prevents internal corrosion and tuberculation, initial high flow capacity is maintained throughout the life of the pipe. Enameline, plus the other advantages of Mono-Cast Pipe, makes it unexcelled for water main service. For full details write our nearest office.

AMERICAN CAST IRON PIPE COMPANY

Birmingham 2, Alabama

Sales Offices in Principal Cities

May 18-19—GEARHEART, OREGON (Gearhart Hotel). Pacific Northwest Section A.W.W.A. Sec'y, Fred Merryfield, Oregon State College, Corvallis, Ore.

June 8—(Meeting place announced later) New Jersey Section A.W.W.A. (Spring Meeting) Sec'y, C. B. Tygert, Box 178, Newark, N. J.

Sept. ——TORONTO, ONT. (Date and hotel later.) Federation of Sewage Works Ass'ns. (Annual Conference.) Exec. Sec'y, H. W. Wisely, 325 Illinois Bldg., Champaign, Ill. (Application to hold has been filed with War Convention Committee, Washington).

Sept. 12-13—FLINT, MICH. (Hotel not selected) Michigan Section A.W.W.A. Sec'y-Treas., M. N. Gerardy, Dept. of Water, Water Board Bldg., Detroit 26, Mich.

Oct. 15-17—(Meeting place announced later) Southwest Section A.W.W.A. Sec'y-Treas., George J. Rohan, Supt. of Water, Waco, Texas.

Nov. 5-7—CHARLOTTE, N. C. (Hotel Charlotte) North Carolina Section A.W.W.A. Sec'y, D. M. Williams, Supt. of Water & Sewerage, Durham, N. C.

Nov. 8-10—ATLANTIC CITY, N. J. (Hotel Madison) New Jersey Section A.W.W.A. (Fall Meeting.) Sec'y, C. B. Tygert, Box 178, Newark, N. J.

IT'S A better place to live, work and play. Because you see, *this* oasis has *soft* water—conditioned by Permutit.*

Permutit removes the hardness and other impurities found in city water supplies, makes the water soft, clear, iron-free. It brings new luxury, labor-saving and cleanliness to every family in town . . . attracts new business and industry. Hundreds of modern cities have found this out after installing Permutit equipment.

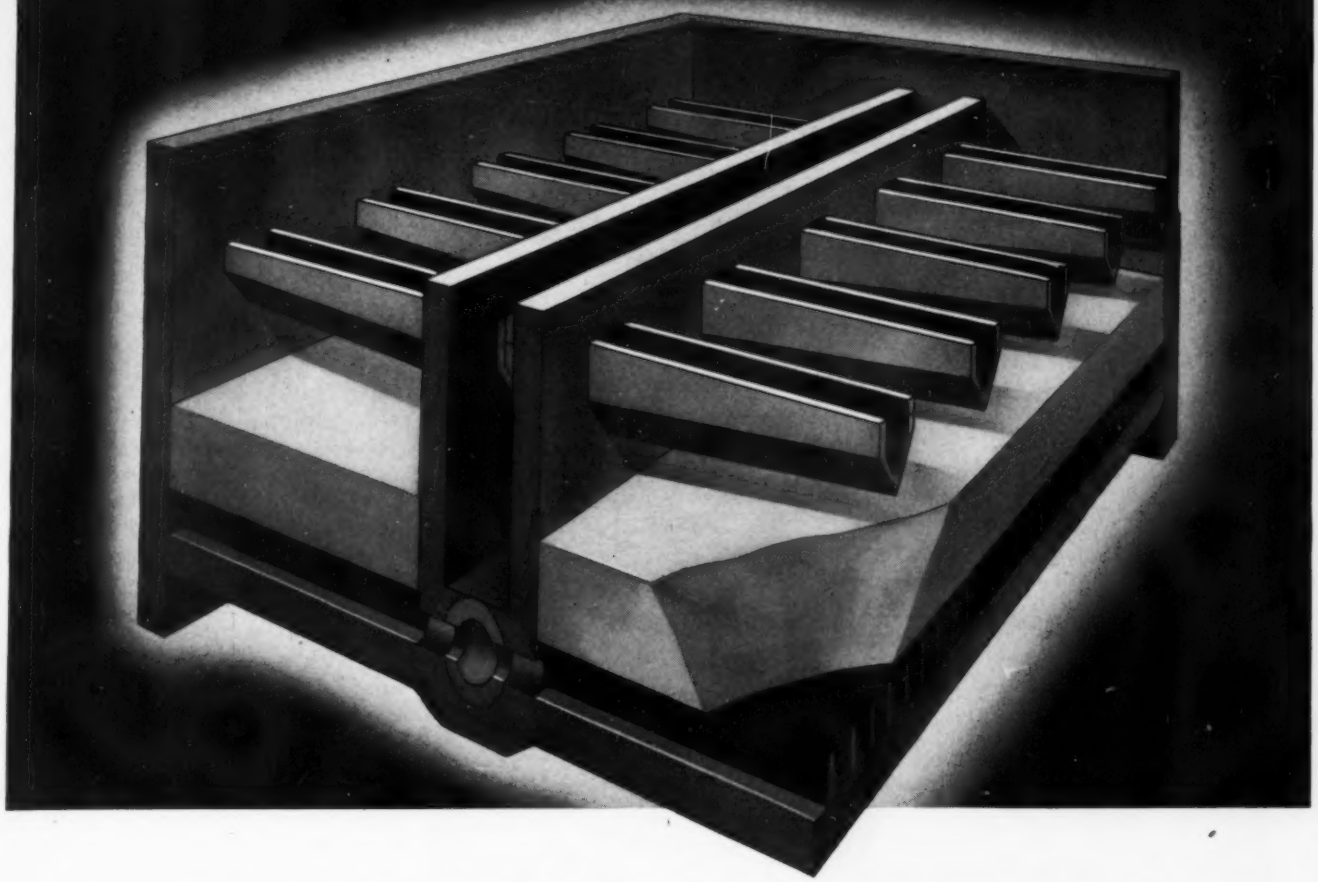
Make *your* city a better place to live in! Write *now* for details to The Permutit Co., Dept. G1, 330 West 42nd St., New York 18, N. Y. or Permutit Co. of Canada, Ltd., Montreal.

PERMUTIT

SOFT WATER for modern cities

WATER CONDITIONING HEADQUARTERS

Simple and low-cost operation . . .



a corollary to the "ALOXITE" porous underdrain system

LOW COST AND EASIER OPERATION are inherent with the "ALOXITE" ceramically bonded aluminum oxide porous plate underdrain system for rapid filters. Its use—

- **Eliminates all graded gravel**
- **Provides complete and uniform backwash**
- **Reduces operating heads**

The sectional perspective drawing shows the simplicity of construction. There is nothing to be disturbed by a violent or uneven backwash. All the difficulties resulting from upsetting of graded gravel and filter media are eliminated. Think what this may mean to you!

With the filter media resting directly on the "ALOXITE" plates, there is only one material to handle if bottom inspection is necessary. And this work can be completed in a very few minutes.

Users of the porous underdrain system consistently report that less wash water is required to maintain clean filter media. This reduces backwashing time. Both of these features provide distinct savings.

Furthermore, smaller pressure loss through the underdrain system plus reduced filter heights result in lower filtering and backwashing operating heads . . . an additional aid in reducing overall costs.

These advantages can be secured in your plant by using the "ALOXITE" porous filter bottom. For more information write The Carborundum Company, Refractories, Div., Dept. W2, Perth Amboy, N. J.

"CARBORUNDUM" and "ALOXITE" are registered trade marks of, and indicate manufacture by, The Carborundum Company.

Porous Products by CARBORUNDUM TRADE MARK

How to Reduce OPERATING COSTS

Photo shows an "R-C" Rotary Positive Blower driven by gas engine. Capacity 800 c.f.m., 720 r.p.m., 8½ lbs. pressure.

ROTARY POSITIVE

in your sewage treatment plant

Make sure your plans and specifications include Roots-Connersville Positive Displacement Aerating Blowers, gas engine driven, using digester gas as fuel.

Simplicity is an outstanding feature of "R-C" Rotary Positive Blowers. There are no restricted passageways, valves, springs, or small wearing parts to require constant adjustment or replacement. Rugged construction assures highest efficiency. In numerous installations, gas generated in the digester tanks furnishes all the power required to operate "R-C" Blowers delivering air needed for complete sewage treatment.

Whether you are planning post-war improvements to your present sewage treatment plant or are considering an entirely new plant, consult us regarding blowers—no obligation.

ROOTS-CONNERSVILLE BLOWER CORPORATION
ONE OF THE DRESSER INDUSTRIES
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Roots CONNERSVILLE SINCE 1854 Aerating BLOWERS

WRITE FOR BULLETIN 23-B-12

Here and There with Doc Symons

HERE'S something for you young fellows to shoot at: Frank Blake, of North Adams, Mass., a mere youth of 90, who invented and makes a darn clever sewer pipe locater and metallic pipe finder, wrote us recently: "I have lost several months' time in hospitals, and business had to be neglected, but since last July's operation [his fourth] recovery has been good, and although over 90 years old, am still locating sewers. In Sept. and Oct., when U. S. Army Flood Control Engineers needed the locations of all pipes crossing both branches of the Hoosac River, I was able and glad to do the field work, carrying and using my instrument over six miles daily and finding it much more satisfactory than lying in a hospital at $5.50 a day." Mr. Blake's sewer pipe locater hasn't received the advertising that some other instruments have, but we should say that this old-timer really has something when the Army Engineers find it useful.

* * *

Help! Help! Now that all the conventions and meetings have been cancelled I'm going to have to depend on my readers' letters to supply this column with items. Since Mahomet can't get out in the field, will the field come into Mahomet? Help! Help!

* * *

Yes, I'm going to miss those conventions, like the Indiana Section Meeting in Indianapolis last year, when Joe Quinn, of the Ind. Bd. of Health, quoted Henry Van Dyke's line, "Rivers are like persons—the greatest are not the easiest to get along with."

* * *

In the Mailbox: I was delighted some months ago to receive a letter from one of our readers in Australia.

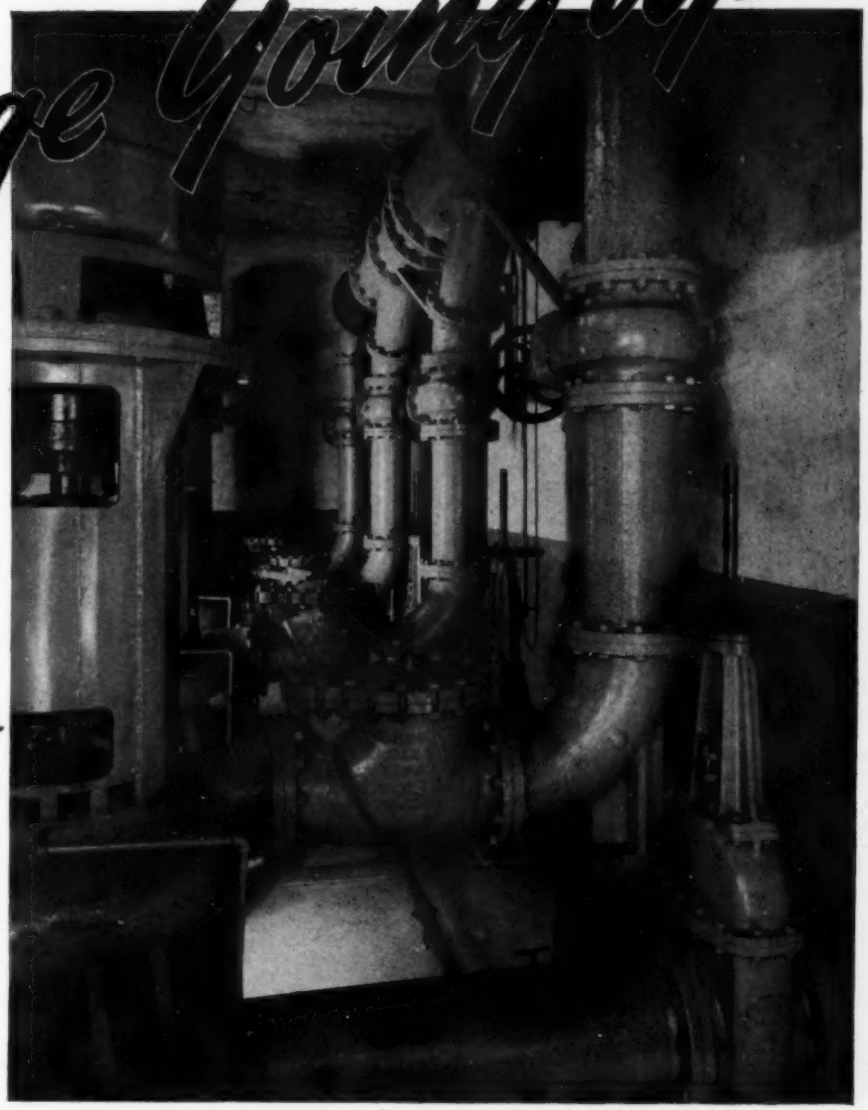
Sewage Going Up

AT

CRANSTON, R. I.

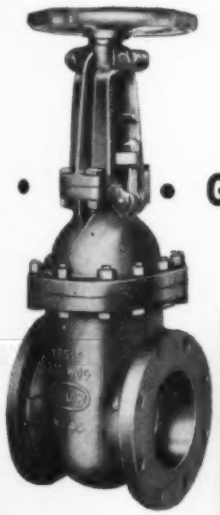
Shown here is the battery of four pumps and valves at the Main Station, Pontiac Avenue, one of five sewage pumping stations already installed for Cranston's 53,000 citizens. The sewerage system project was planned for the future. It includes about 150 miles of sewers and service connections, seven sewage pumping stations, and complete sewage treatment works. Each centrifugal pump has two Ludlow 300 lb. Test Double Gate Valves (Outside Screw and Yoke Type) on suction and discharge connections, and a Ludlow Clear Opening Check Valve with Outside Lever and Weight in discharge piping. The system also employs Ludlow Sluice Gates.

Ludlow Valves and Sluice Gates assure peak efficiency, long life and a minimum of service requirements.



Suction and Discharge Piping with Ludlow Valves at Main Sewage Pumping Station — Pontiac Avenue, Cranston, R. I.
Two Pumps — 3000 gallons per minute, variable speed units.
Two Pumps — 3500 gallons per minute, constant speed units.

Fay, Spofford & Thorndike, Boston, Engineers
Yeomans Bros. Co., Chicago, Contractors for Sixteen Pumps
Ralph P. Hall, Inc., Boston, Subcontractors for Installations



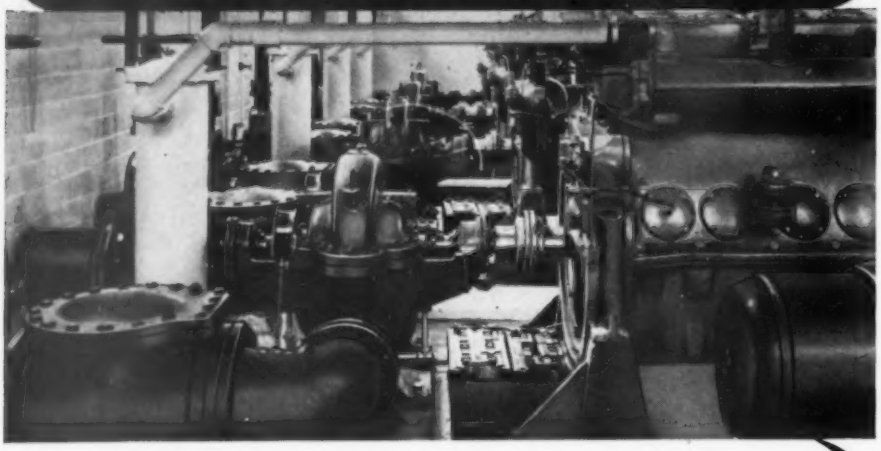
• • GATE VALVES • CHECK VALVES • SLUICE GATES •

W-5

The LUDLOW VALVE
SINCE 1866
MFG·CO·INC·TROY·N·Y·

MORRIS *Pumps*

with direct diesel drive exceed planned output by 13%



This battery of Morris Pumps in New London, Conn. adds 150 million G.P.D. to city's water supply. Completed August, 1944.

IN THIS modern pumping station, four Morris double-suction, horizontally split centrifugal pumps, specified for 1750 gpm each, actually deliver up to 2000 gpm—approximately 13% plus capacity—without over-loading the engine. Driven by 150 hp diesel engines, each unit pumps against 125 foot total dynamic head, at a speed of 1140 rpm.

An interesting mechanical departure in this installation is the omission of gears between engine and pump. But without this intermediate gearing common to diesel drive, Morris hydraulic engineering met and surpassed requirements. Economically, too—only four mills fuel cost per 1000 gals., at 1140 rpm.

New England has always favored the efficiency, economy and stamina of Morris Pumps. Among the numerous installations by the Starkweather Engineering Co., of Newton, Mass., Morris representatives, are:

Bangor Airport, Me.
Grenier Air Field, N. H.
Cities of Concord, N. H.
Dover, N. H.
Chicopee, Mass.
Haverhill, Mass.
Hartford, Conn.
Keene, N. H.
Lynn, Mass.
New Bedford, Mass.
Springfield, Mass.
Waterville, Me.
Woonsocket, R. I.
Bristol, R. I.
Brookline, Mass.
Concord, Mass.
Fairhaven, Mass.
Milton, N. H.
Nahant, Mass.
Nantucket, Mass.
Raymond, N. H.
Scituate, Mass.
Warren, R. I.
West Springfield, Mass.
Leominster, Mass.
Newport, R. I.
Town of Saugus, Mass.
Waterville, Me., District
Metropolitan District
South Essex Sewage District

MORRIS MACHINE WORKS
Baldwinsville, N. Y.
Branch Offices in Principal Cities

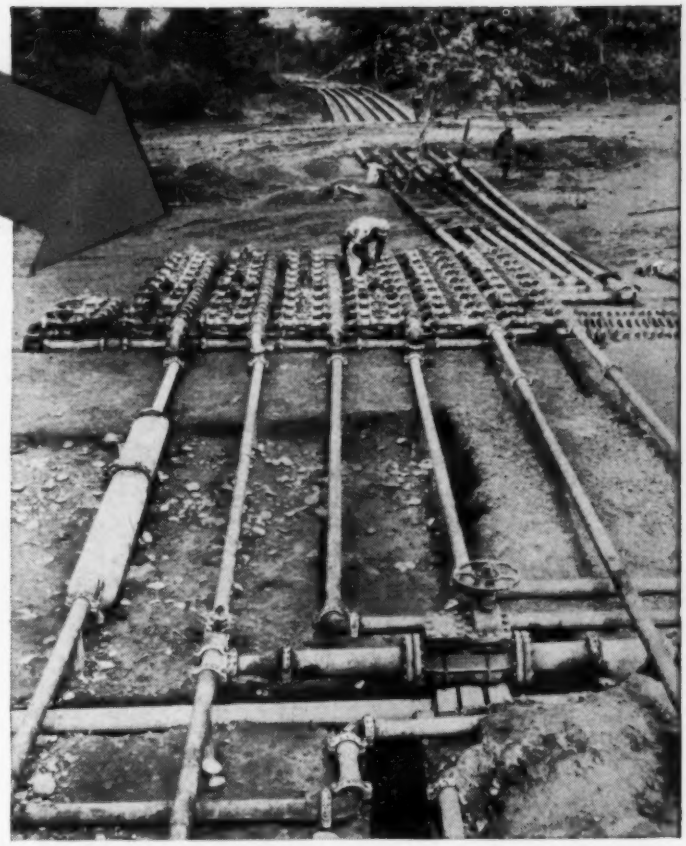
MORRIS CENTRIFUGAL PUMPS

Yes, sir! Mr. Caldwell, Director of Gibson, Battle (Melbourne) Pty., Ltd., in writing about one matter was quite complimentary about the column and dropped a hint that they are negotiating with one of our larger manufacturers of sewage treatment plant equipment to represent them in Australia. - - - Maj. Chas. C. Agar, with Hdq. of the 3rd Army somewhere in France or Germany, says he's retrogressed as a sewage specialist. . . . "Imagine sewage treatment by the slit trench method, a blanket of earth to simulate covered sludge digestion." . . . Charlie has slept so long in one of those "—— sacks" that he's forgotten what a bed is like. I had almost forgotten that Charlie wrote me from England before D-day last June saying he'd visited several sewage works there, noting that 50-60 per cent of the operators are women. So far as I know, by contrast there are less than half a dozen women in U. S. sewage plants. - - - Bill Piatt of Durham wrote, anent my comment last month on his birthday party, etc., "Thanks for the plug on the birthday party. Glad you didn't mention that the orchestra played 'The Old Gray Mare Ain't What She Used to Be,' and just to keep history straight, you should know that I am a damyankee myself, and more than that, a Pennsylvania Democrat; so that I didn't have to change my politics when I came down here 46 years ago with the ink hardly dry on my sheepskin." - - - A. F. "So" Dappert has gone on the list for special mailings of this column, thereby adding a third front that "Here & There" reaches.

* * *

When I wrote the January column and expressed an editorial opinion on our present out-moded and outdated system of weights and measures and calendars, it was a foregone conclusion that someone would object strenuously. Well, that one strenuous objector is E. A. "Nuchar" Sigworth, who after expressing (in somewhat more than 200 words) all the difficulties that would entail in a change, says, "Frankly, Doc, I am very surprised at the views you have expressed. . . . I naturally prefer many of the old systems to these modern day notions." - - - Hmmm! Wonder what "Siggie" would be doing now if a lot of old-time filter operators like my Dad had felt the same way about trying out that new fangled powdered carbon (*activated* I believe was the new term applied) for removing tastes and odors from water.

WORLD'S LONGEST PIPELINE — Part of a 2000-mile line from India to China. Laid through some of the worst terrain in all the world, this line is subjected to every imaginable strain . . . It is coupled by Victaulic.



THROUGH JUNGLE RIVERS the fast-working 775th Army Engineers lay part of the 2000-mile vital pipeline. Despite the constant pressure of powerful river currents Victaulic couplings insure lock-tight, leak-proof joints.

WAR BONDS
A PIPE LINE TO VICTORY
BUY TO WIN

The terrific job of "fueling" our armies overseas does not end when the tankers unload at the ports. Too little known is the amazing story of the thousands of miles of Army pipelines that are laid at top-speed, often under fire — and must be able to withstand extreme strains of terrain and battle conditions. Millions of Victaulic couplings have been used on these Army pipelines — for these two special reasons . . . their speed and ease of assembly . . . their ability to provide a flexible, leak-tight joint, and to go on providing it under even the worst conditions.

SO THAT YOU can find out more about these Couplings, get the color-illustrated Victaulic Catalog and Engineering Manual. No obligation — simply drop us a line on your company letterhead. Write to: VICTAULIC COMPANY OF AMERICA, 30 Rockefeller Plaza, New York 20, N. Y. Other Victaulic offices — Victaulic Inc., 727 West 7th St., Los Angeles 14, Cal.; Victaulic Co. of Canada, Ltd., 200 Bay St., Toronto.

VICTAULIC

Reg. U. S. Pat. Off.

SELF-ALIGNING PIPE COUPLINGS AND FULL-FLOW FITTINGS

OIL MINING MARINE MUNICIPAL INDUSTRIAL

Copyright 1945 Victaulic Co. of America

Generator and Pump Drive—
BUFFALO RA-8 ENGINE,
Texarkana, Ark.

A COMMUNITY—or an institution or industrial plant—whose fire protection has been made complete by a Buffalo Engine installation for stand-by pump enjoys a valuable privilege. Its fire insurance rates are less, returning many times the cost of the equipment.

But it is likely that in any community there are too few people who have full understanding of this protection. They are engineers who appreciate their design and construction—or operating men who know by experience the reliable starting and smooth-running, constant speed and uniform power delivery of Buffalo Engines.

The experience of this Company with hundreds of such important installations is available to engineers, public officials and others who are interested in *assurance* of protection. Write for motor specifications for your files or for comparison—or for any other information that interests you.

BUFFALO GASOLENE MOTOR COMPANY

DEPT. WW-35 BUFFALO 13, N. Y., U. S. A.

BUFFALO ENGINES

ASSURANCE of PROTECTION

BUFFALO ENGINES — 100 H. P. THROUGH 750 H. P.— IN GENERATOR AND PUMPING SETS FOR WATER WORKS — AIRPORTS — COMMUNICATIONS — FLOOD CONTROL — HOSPITALS — INSTITUTIONS — MINES — MOVABLE BRIDGES — THEATRES — SEWAGE PLANTS.

It is not just since I joined the ranks of "unnecessary excresences" that I have been the target of the jibes of friends (?). Back in our high school days when I was a chemist in a water plant, the following "poem" appeared in the High School monthly magazine, written (with apologies to the Old Oaken Bucket) by one Tom M. Dale, now an insurance executive.

WATER

How dear to our hearts is the taste of good water,
When fond recollection presents it to view;
Spring water, well water, the swift rippling brooklet,
And every loved kind which our palate once knew;
The sweet flavored water and things that went with it,
So cool and so pure in the place where it fell
O'er rocks in a creek with the old farmhouse by it,
But these recollections are too good to tell,
And instead of our water in an old oaken bucket
We have to drink water we e'en dare not smell;
Our "fertilized" water,
Our black, filthy water,
That horrible water
That ne'er saw a well.

* * *

If you recall this column for last month you may remember that I discovered that IMG, the noted consulting engineer of Harrisburg, Pa., was none other than Mike Glace, only to have him present me with another mystery when I saw the following stuck in his coat lapel at a sewage works meeting in New York.

P_3 B_3 P_2
ASSOCIATION

W. W. & S. W.
AFFILIATE
ACTIVE MEMBER

Anyone know what this darn thing is?

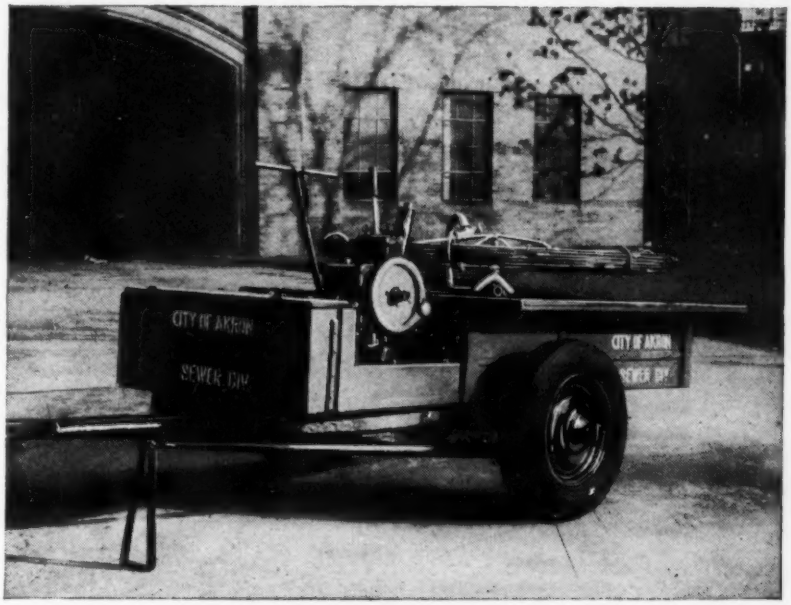
Complete FLEXIBLE-EQUIPPED SEWER-CLEANING DEPARTMENT

MOUNTED ON SMALL EASY-TO-MAKE TRAILER

There are many advantages in this Flexible equipped trailer for any city. It can be hitched to any car or truck in the city yards . . . it is light enough to be pulled by hand from manhole to manhole . . . it is **completely** equipped with Flexibles to handle any sewer cleaning job . . . no need to run back to the yard for special tools. And, dig-ups are seldom necessary.

This trailer, designed by G. J. Hoerbelt of the Akron Sewer Dept., is built of used Ford parts. It is easy to build and inexpensive. **Free blueprints** of the trailer are available by writing to Flexible.

Write for Plans of This Easy-to-Build Trailer



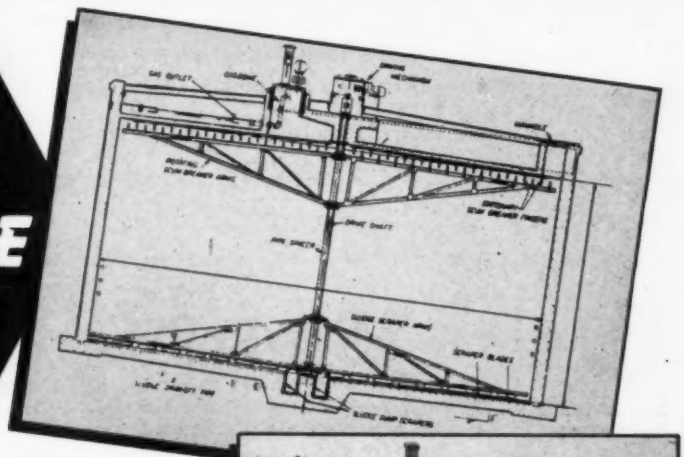
615 Pickwick Bldg.
Kansas City 6, Mo.
1624 Harmon Place
Minneapolis 3, Minn.
P. O. Box 694
Gulfport, Miss.
41 Greenway St.
Hamden, Conn.

FLEXIBLE SEWER-ROD EQUIPMENT COMPANY

9059 Venice Boulevard — Los Angeles 34, California

401 Broadway
New York 13
2645 E. 75th St.
Chicago 49
P.O. Box 694, Pittsburgh
P.O. Box 165, Atlanta
147 Hillside Ter.
Irvington, N. J.

CARTER *FIXED ROOF SLUDGE* DIGESTER



- Sturdy rugged design . . . a tough unit built to adequately handle a tough sewage treatment job.
- Totally enclosed triple reducer drive direct connected to double parallel gearhead motor . . . eliminates inefficient chain drive . . . minimizes maintenance.
- Mechanical and electrical overload protection . . . doubly safeguards entire mechanism from damage.
- Galvanized steel gas dome . . . fabricated from heavy plate, electrically arc welded, then hot dipped to prevent corrosion.

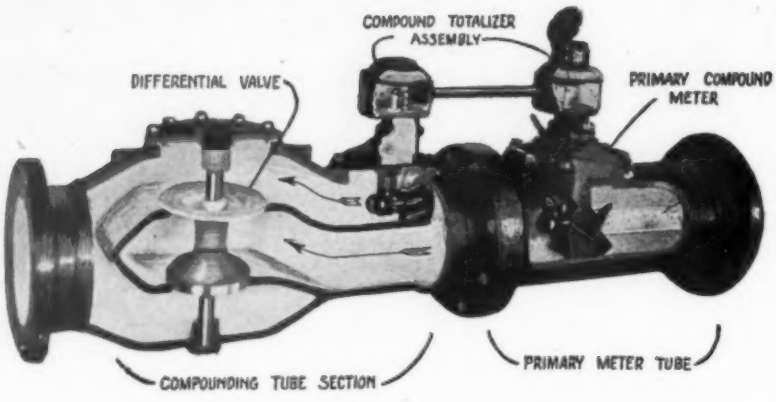
More and more the swing is back to fixed roof digestion. Satisfactory gas collection, efficient continuous break up of surface scum and positive movement of ripe sludge from tank periphery to center pocket are a few of the reasons. Dangers of cover tilting, short circuiting, and loss of storage space due to excessive grit deposits are eliminated. Our engineers will gladly advise you on your requirements, or—

Two 45' diameter CARTER units operating at the Town of Tonawanda, N.Y. Consulting Engineers — Nussbaumer & Clarke, Buffalo, N.Y. General Contractor— C. E. Knowles & Co. Inc., Gowanda, N.Y.

➡ ***Write for Bulletin 4311***

RALPH B. CARTER CO. HACKENSACK, NEW JERSEY
53 PARK PL., NEW YORK 7, N. Y.

SPARLING MAIN-LINE METERS



COMPOUND METERS

Accurate Over Wide Range of Flows

IN the cut-away view above, the flow is from right to left. Note the valve which begins to open, bypassing the small meter, when the flow reaches the minimum rate of the larger meter.

Registration is accurate over flow ranges as wide as 1 to 125.

There is no sharp cut-over point and the pressure loss, less than 2 pounds per square inch, is the lowest of any compound.

Indicators, Recorders and Controls are optional with all Sparling Meters.

Get the facts from Bulletin 308

R. W. SPARLING *Manufacturers of Water Measuring Equipment*

LOS ANGELES 54...Box 3277 Terminal Annex
CHICAGO 16.....3104 South Michigan Ave.
622 Broadway.....CINCINNATI 2
101 Park Avenue.....NEW YORK 17
BOSTON 8.....6 Beacon Street

ZECO GREENSAND ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

ZEOLITE CHEMICAL CO.
Sales Office 140 Cedar St., New York, N. Y.
Factory Medford, N. J.
Pioneer Producer of GREENSAND ZEOLITE MINERAL

..for ACCURACY and TROUBLE-FREE OPERATION

INSIST ON THE WILSON HYPO-CHLORINATOR

Engineered and Manufactured by

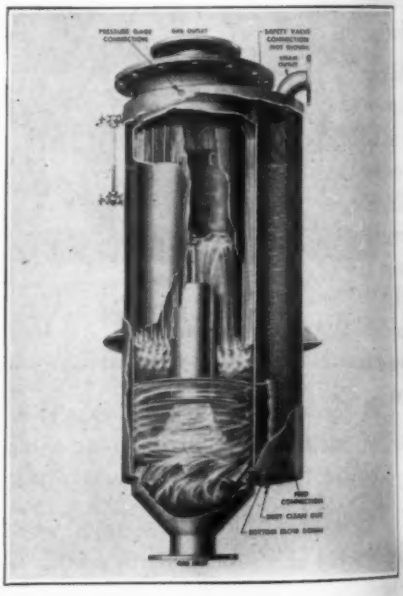
WILSON CHEMICAL FEEDERS, INC.
203 CLINTON STREET BUFFALO 4, N. Y.

In the galley of Sam Newkirk's article on Water Supply Developments for the Jan. 1945 issue, the following paragraph appeared: "The Homelite Corp. started production of a new portable centrifugal pump with aluminum cylinder and piston and a *magnate* with all ignition parts quickly and easily accessible." In the final print the word was changed to "magneto," but maybe Homelite really did start production on a new type of magnate—Robot, no doubt.

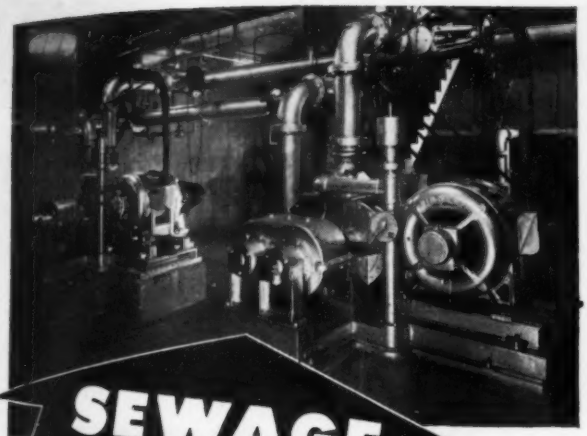
MANUFACTURERS' and EQUIPMENT News

Vortex Heat Recovery Silencer for Diesels

We know that the Diesel engine has been finding more and more use as a standby unit in water and sewage plants. We also know that the exhaust from Diesel engines is generally noisy and objectionable unless muffled or "snubbed."



Newest item in this class of equipment is the Vortex Heat Recovery Silencer for Diesel engines manufactured by the Engineering Specialties Co., 39 Cortlandt St., New York 7, N. Y. This new Vortex Heat Recovery Silencer combines four functions in the one unit: steam



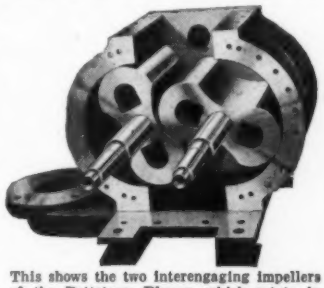
SEWAGE DISPOSAL *Overloaded?*

This sewage disposal plant serves a war boom city bursting its seams with a swollen population and expanded industry. Sewage disposal is loaded far beyond the capacities for which it was designed. These POTTSTOWN BLOWERS demonstrated their efficiency under *accelerated* aeration and activation of the sludge tanks.

Efficient positive displacement with these blowers is accomplished because their precision machining permits exceptionally close tolerances on moving parts. Their efficiency is maintained during long life because there is no actual contact or friction between the impellers themselves—nor between impellers and casing interior. *No wearing parts here!*

With friction eliminated, interior lubrication is unnecessary. Only clean air—uncontaminated by lubrication—is delivered to your filters or diffusers. No valves, springs or other friction parts to wear out or to necessitate repairs. Simplicity of design . . . sturdy construction . . . precision machining—THESE FEATURES eliminate maintenance and adjustments, *even on daily 24-hour service!*

Write today for our *new* Bulletin.



This shows the two interengaging impellers of the Pottstown Blower, which rotate in opposite directions. The concave portion of each impeller alternately carries an impulse of clean air from the bottom inlet half around the interior of the casing wall and forces it through the top outlet. At operating speeds, these alternating impulses of air merge into a continuous flow.

ALLEN BILLMYRE COMPANY
640 Fayette Ave., Mamaroneck, N. Y.

POTTSTOWN
ROTARY POSITIVE DISPLACEMENT
BLOWERS

To the Most Important Man in the Community

ARMY E NAVY

THERE is no one man more important to the health and safety of the community than the Water Works Official. Upon his shoulders rest the health and very life of every citizen. Yet if you stopped ten men, or twenty or a hundred and asked the name of this important individual, the chances are pretty great that not one would be able to answer.

Yet this very anonymity is silent praise of you and your work. Let there be but one breath of suspicion against the purity of the water supply and your name would be on everybody's lips.

In Hooker Chlorine you have a powerful protector of your anonymity. Early in the field to produce chlorine electrolytically, Hooker has been providing high quality, high purity Liquid Chlorine to water works, filtration plants and sewerage systems for many years. The vigilance of water works officials plus the uniformly dependable supplies of Hooker Liquid Chlorine have helped to maintain the high sanitation standards of the United States.

Along with Hooker's production of Chlorine goes the offer of help on any of your problems involving the use of this chemical. Hooker's Technical Staff is continuously working with chlorine and their specialized knowledge is available to you in helping you overcome any difficulties that to-day's material and manpower shortages may cause.

HOOKER
ELECTROCHEMICAL COMPANY
Buffalo Ave. & Ward St.
Niagara Falls, N. Y.
NEW YORK, N. Y. • TACOMA, WASH. • WILMINGTON, CALIF.

Chlorine ***Bleaching Powder***
Caustic Soda ***Ferric Chloride***

HOOKER
CHEMICALS

The *Coagulant* that *Cuts Costs!*

TENNESSEE CORPORATION Ferri-Floc

Ferri-floc . . . the ferric coagulant that is successfully and economically used in sewage treatment throughout the United States. Take advantage of modern plant research and findings: use Ferri-floc. Tennessee Corporation's technical staff will be glad to help you with your specific problems. Write to us today. The consultation service is free, of course.

The Mark of Quality

TC TENNESSEE CORPORATION

Tennessee Corporation

ATLANTA, GEORGIA LOCKLAND, OHIO

CONTRACTS

Completely Installed

Water Works and Sewerage Plant Equipment

Turbine Equipment Co.

75 West St.

New York 6, N. Y.

TAPAX

The ORIGINAL *and* FINEST....

Manhole Cushion U. S. Pat. No. 2,050,050 offers you the simplest solution for noisy, rattling covers. Easy to install. Lasting — Economical.

Write for story of Tapax and Trial Offer.

TAPAX MFG. CO., INC.

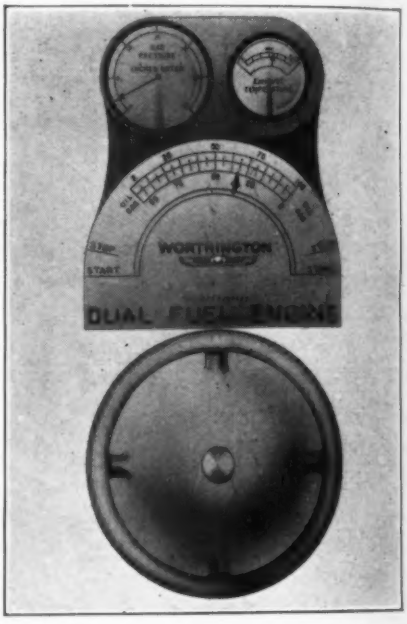
MAMARONECK NEW YORK

generation up to 30 lb. psi., hot water heating, exhaust silencing, and removal of sparks and carbon from exhaust gases.

With engines that operate on sewage gas, this unit may see more adoption in this field.

Worthington Dual Fuel Diesel Engine

Worthington is now producing an engine capable of instantaneous conversion from oil to gas fuel without change of load or speed. The change is accomplished mechanically by one revolution of a single wheel. Regardless of which fuel is being used, the engine operates on the highly efficient Diesel cycle, thus realizing fuel economies heretofore unobtainable in gas engine operation. When operating as a gas engine, pilot oil ignition is used, eliminating electric ignition. Pilot fuel amounts to but 5 per cent of the total full load Btu. requirements of the engine.

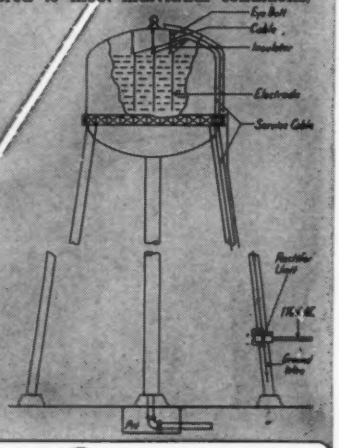


The system is produced to cover the entire range of Worthington's Diesel sizes, and it is well suited for use in sewage plants as well as in industrial and municipal power plants, and by the gas utilities for compressor drive, etc. These Gas-Oil Diesels now being produced in the Buffalo plant of Worthington Pump and Machinery Corp., sound like the answer to the problem of independent power production at sewage plants where sludge gas production may prove insufficient for full power requirements at times.

For descriptive literature or additional information address Worthington at Harrison, N. J., or Buffalo, N. Y.

STOPS TANK RUSTING *Below the Water Line* PERMANENTLY!

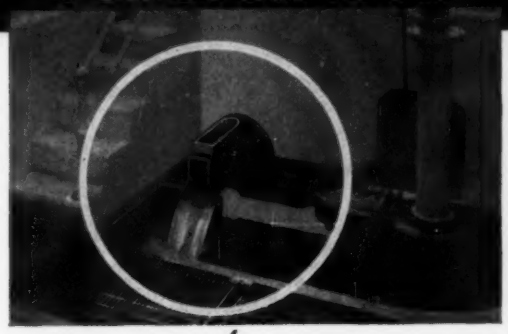
Rust below the water line is by far the most troublesome, expensive and destructive item of tank maintenance. But it can be eliminated completely—permanently. A proven electrolytic system (Cathodic Protection), carefully engineered to meet individual conditions, stops all rust formation—even removes old rust. Installed without draining the tank. Costs pennies to operate. Safe, low voltage. No paint, no chemicals. And no more rust, no more scraping or painting. Applicable to many types of submerged metal equipment. Method approved by Associated Factory Mutual Laboratories, War Department (Chief Engineer's Office) and American Water Works Assn. Write for facts—NOW.



ELECTRO RUST-PROOFING *Corporation*

DAYTON 10, OHIO, U.S.A.

FOR OPEN FLOW



16" Kennison Nozzle at Belgrave Sewer District, Great Neck, Long Island.

BUILDERS *Kennison Nozzle*

Accurately measures flow of sewage and sludge through partially filled pipes or open channels where there is a wide range in flow rates. Available in sizes 6" to 36"; used with Builders Instruments for totalizing, rate indicating and recording.

Write for illustrated Bulletin 334A. Address Builders-Providence, Inc. (division of Builders Iron Foundry), 9 Codding St., Providence 1, R. I.

"BLUE PRINT NOW"

Sincerely
BUILDERS-PROVIDENCE

DANGER! *Spring Thaws*

Spring rains and spring thaws will flood streets and overtax sewers, *but* you can *prevent* the overflow from rain, flood or tide water from backing up through sewers carrying unsanitary waste and debris with them . . . you can *prevent* them from backing up through sewer lines into the basements of the homes, stores and factories in your community. Install Josam Backwater Sewer Valves at the proper location in sewer lines and this danger will be eliminated. A type and size for every condition. Made with side swing flap that can be adjusted to closed seat type if desired. Josam Backwater Sewer Valves are sold by local plumbing supply wholesalers. Write for free folder on "How to control Backwater."

JOSAM MANUFACTURING COMPANY

(FOUNDED 1914)

Executive Offices, 320 Empire Bldg., Cleveland, Ohio • Manufacturing Division, Michigan City, Indiana

Representatives in all Principal Cities

JOSAM-PACIFIC CO. 785 Folsom Street, San Francisco, California — *West Coast Distributors*

THERE ARE NO SUBSTITUTES FOR JOSAM PRODUCTS

THE SEWER SCOOTER

U. S. PATENT 2198823

THE ONLY 100% SELF-PROPELLING SEWER CLEANING MACHINE

Sewage in the Line Furnishes the Propelling Power

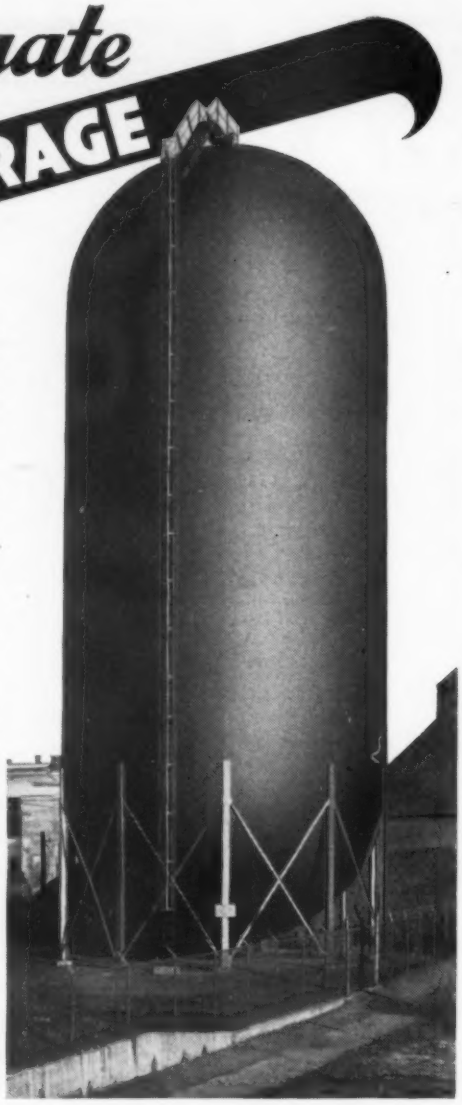
BUILT IN SIZES 8" AND UP

A sewerage system that has once been completely cleaned with the Sewer Scooter is easily kept to its original carrying capacity by infrequent patrollings of the lines.

J. C. FITZGERALD

P. O. BOX 289, CORAL GABLES 34, FLORIDA

For adequate Reserve GAS STORAGE



Stacey "Bullet" type high pressure tanks are used by municipally-owned gas plants for reserve gas storage against line breaks, and for use during peak loads or for serving outlying territories. Stacey Brothers "Bullets" are also used for the storage of digester gas produced in sewage treatment plants.

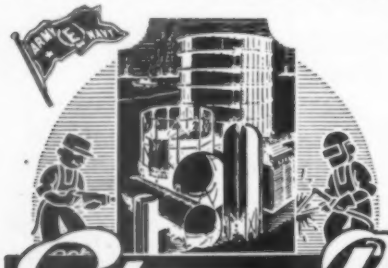
We build this type of holder in capacities up to 500,000 cu. ft., and for pressures up to 100 pounds. They may be erected vertically or horizontally. Stacey Brothers "Bullets" have many exclusive features of design and construction which add greatly to their strength and durability. Let us figure on your requirements.

The STACEY BROS. GAS CONSTRUCTION CO.

One of the Dresser Industries

5535 Vine Street, Cincinnati 16, Ohio

As far as is known, the Stacey Brothers all-welded High Pressure "Bullet" shown in the photo is the largest in the world. Its capacity is 400,000 cu. ft.



High Pressure **BULLETS**

Stacey Brothers ENGINEERS · FABRICATORS ERECTORS · RECOGNIZED EXPERIENCE & FACILITIES

AMERICAN GAS BOILERS

STEAM AND WATER TYPES

FOR DIGESTER HEATING

SEE DATA PAGE IN ANNUAL REFERENCE SECTION

AMERICAN RADIATOR & Standard Sanitary

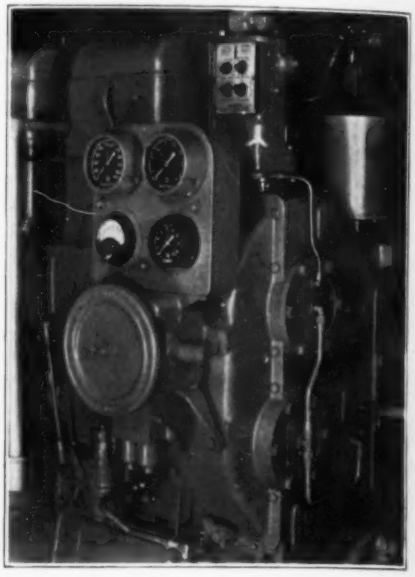
New York CORPORATION *Pittsburgh*

SALES OFFICES IN ALL PRINCIPAL CITIES

Cooper-Bessemer Announces Dual-Fuel Diesels

New Design Cuts Gas Consumption by 25 Per Cent

The Cooper-Bessemer Corp. of Mount Vernon, Ohio, has announced a new Diesel engine which will operate on either gas or oil as fuel without any electrical sparking device. At the same time, fuel consumption when using gas is reduced by from 20 to 25 per cent.



Control End of New C-B Dual Fuel Diesel, Showing Gas-Oil Operating Mechanism.

The improved unit will operate on a wide variety of fuels, including natural gas, fuel oil, manufactured and coke oven gases, or sewage sludge gas. The conversion from liquid to gas fuel is as simple as the closing of one valve and the opening of another. During the change-over the engine can be operating at full load or fractional load, as the case may be.

For literature or additional information on this improved flexible engine, which bids fair to broaden the application of gas engines in sewage plants as the sole source of power without fear of gas deficiency at any time, address Cooper-Bessemer Corp., Mt. Vernon, Ohio.

Anti-Corrodes for Rust Prevention

If rust causes a loss of $100,000,000 a year, then it should pay to know **How to Prevent Rust and Corrosion,** and the Cities Service Oil Co. of New York and Chicago says that its Anti-Corrodes for industry is just the way to do it.

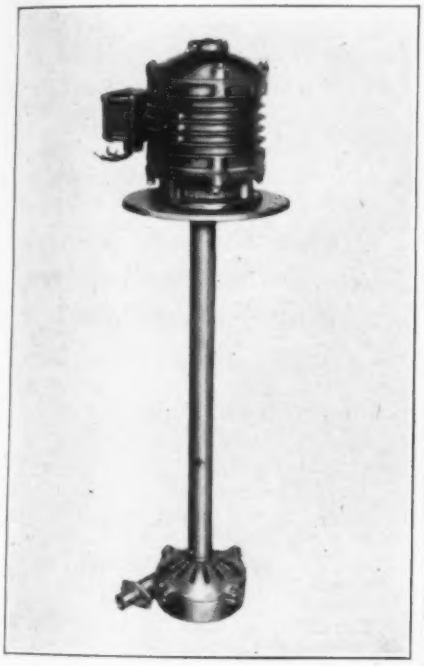
There are more than 35 of these Cities Service Anti-Corrodes made

for various industrial applications. Anti-Corrodes are available in three types: oil, solid, and cutback. Composed with a petroleum base, Anti-Corrodes also serve as lubricants, reach places difficult of access, and are resistant to moisture, sun rays, and are chemically inert to ferrous and nonferrous metals. Anti-Corrodes may be applied by dipping, brush, or spray.

Literature from the company indicates these Anti-Corrodes are recommended in factories, mines, railroads, power plants, for marine use, for construction equipment, for dwellings, and for public works. Cities Service Oil Co. doesn't say so but we have a hunch that these public works might well include water and sewage plants.

Schneible Wear-Proof Pumps

Schneible "Wear-proof" pumps were originally built with horizontal discharge only, but they are now available in the vertical discharge model. These pumps were originally developed for use in the wet-method dust collecting dewatering systems.



Built to withstand the abrasive action of this type of sludge, these pumps with exceptionally durable wearing parts are applicable in handling sludges, slurries, and heavily loaded liquids. These pumps are available in sizes from ⅜ in. to 1¼ in. A more complete description is found in Bull. No. 1244, which may be obtained from Claude B. Schneible Co., 2827 Twenty-fifth St., Detroit 16, Mich.

SMITH TAPPING MACHINES

THE A. P. SMITH MFG. CO. EAST ORANGE, N.J.

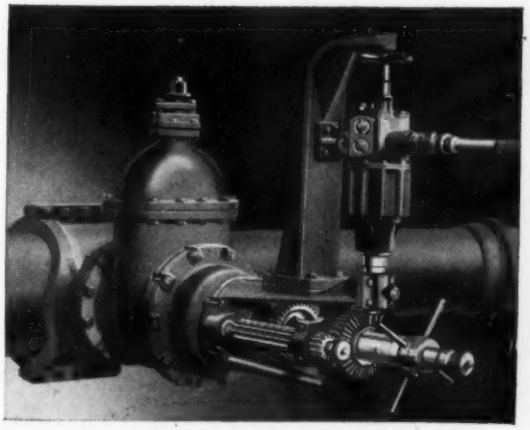
Symbol of Quality Since 1889

You Can Make a Branch Connection Without Stopping Service

If increased demands for water, due to the National War effort, make it necessary for you to plan new extensions to your existing pipe lines, you can make the necessary branch connection with a **SMITH TAPPING MACHINE**

without interrupting the continuous flow of vital water to other points on the same line. These machines are made to make taps from 2 inches to 42 inches. They are easy to handle and economical to use and are the most reliable machine for the purpose made.

The larger machines are for rent and we supply supervision in their use. The smaller ones may be bought or rented.



Above: Smith Tapping Machines, for making branch connections to water and gas mains under pressure, have been standard equipment throughout the U. S. since 1889.

OTHER SMITH PRODUCTS
Valves and Hydrants — Valve Inserting Machines — Tapping Sleeves — Tapping Valves — Hat Flanges

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Branches
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THE A. P. SMITH MFG. CO., EAST ORANGE, N. J.

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

KNOWN AROUND THE WORLD AS THE SIGN OF EXCELLENCE IN WATER TREATMENT EQUIPMENT

The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

GRAVITY FILTERS • SOFTENING PLANTS AND EQUIPMENT • PRESSURE FILTERS ZEOLITE SOFTENERS • SWIMMING POOL RECIRCULATING APPARATUS SPECIAL WATER TREATMENT EQUIPMENT

We invite your inquiries

ROBERTS FILTER MANUFACTURING COMPANY • *Darby, Pa.*

DOW
FERRIC CHLORIDE
35-47% SOLUTION
Shipped in Tank Cars
60% CRYSTALS
Packed in 300 or 500 lb. Barrels
★ SLUDGE CONDITIONING
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THE DOW CHEMICAL COMPANY
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ACCELO-FILTER FOR SEWAGE TREATMENT
DIRECT RECIRCULATION
PRIMARY CLARIFIER
CONTROL WELL
TRICKLING FILTER
EFFLUENT WELL
FINAL CLARIFIER
Increases biological treatment efficiency without necessitating any increase in size of either primary or final sedimentation tanks. Ask for Bulletin 6200.
INFILCO
INFILCO
INCORPORATED
325 W. 25TH PLACE, CHICAGO 16, ILL.

"Hal" Hutton Honored on 25th Year with W. & T.

Just 25 years after he joined Wallace & Tiernan on Feb. 9, 1920, Harold S. Hutton, Sales Manager of W. & T., was honored by his associates at a dinner at the Montclair Golf Club, Montclair, N. J.

H. S. Hutton

A graduate of Columbia University in 1916 with the degree of Civil Engineer, an officer in the U. S. Public Health Service and a 1st Lt. in the Engineer Corps in World War I, Mr. Hutton is a member of ASCE, APHA, AWWA. His fraternities are Delta Tau Delta, Tau Beta Pi, and Sigma XI.

Mr. Hutton was a Division Manager for W. & T. with headquarters in Pittsburgh, for a number of years prior to coming to Newark as Sales Manager.

Warren Foundry & Pipe Corp. Elected to Gray Iron Founders' Society

Warren Foundry & Pipe Corp., New York City, manufacturers of iron gas and water pipe and special castings, has been admitted to membership in the Gray Iron Founders' Society, the national association of producers of engineering gray irons.

Northrupp & Co. to Distribute Copper Tubing

Announcement has been made that Northrupp & Co., Inc., N. Y. City, makers of Bondo, jointing compound, has made arrangements to distribute the Chase Brass and Copper Co. line of copper tubing, fittings and water works brass goods. After all war restrictions are removed, Northrupp & Co. plans to warehouse copper tubing in leading cities throughout the country, to facilitate prompt deliveries.

R. E. Sprenkle Bailey's Hydraulic Engineer

The appointment of Mr. R. E. Sprenkle as hydraulic engineer of Bailey Meter Co., Cleveland, Ohio, has recently been announced by H. M. Hammond, General Sales Manager. In this capacity Mr. Sprenkle will continue to act as consultant and supervise research on problems of fluid flow. He will also cooperate with civil and sanitary engineers in working out the problems of metering and control equipment arising during the design of water supply and sewage treatment plants.

R. E. Sprenkle

Mr. Sprenkle has been associated with Bailey Meter Co. for over twenty years, during which time he has conducted investigations in the hydraulic laboratories of numerous engineering schools, has served for many years as a member of the A. S. M. E. Research Committee on Fluid Meters and has had a wide experience in the practical application of industrial metering equipment.

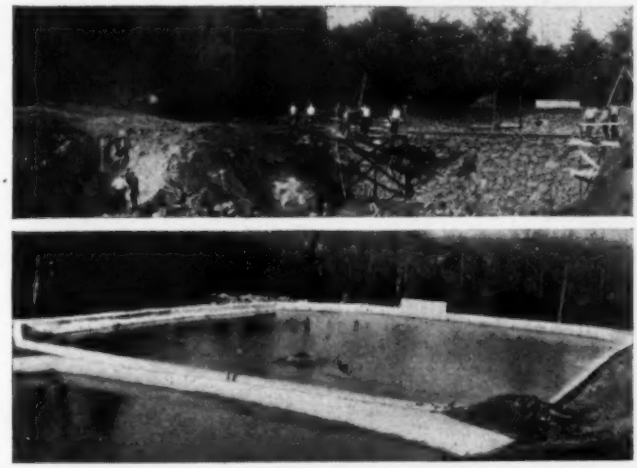
Gaus Heads Gardner-Denver's N. Y. Office

Gilbert H. Gaus has recently been appointed manager of the Gardner-Denver Company's New York branch office at 76th Ninth Ave. He succeeds G. V. Leece, vice-president, who has been placed in charge of the company's Export Division.

For the past seven years Mr. Gaus has been with the Gardner-Denver New York office as sales engineer. Previous to joining the company in 1938 he had 18 years' experience in engineering and sales of pumps and other mechanical and electrical equipment for industrial plants, power plants, water works and sewage plants.

Mr. Gaus, who served as an officer in World War I, was graduated by the Massachusetts Institute of Technology in 1917 and is a licensed professional engineer in the State of New York.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

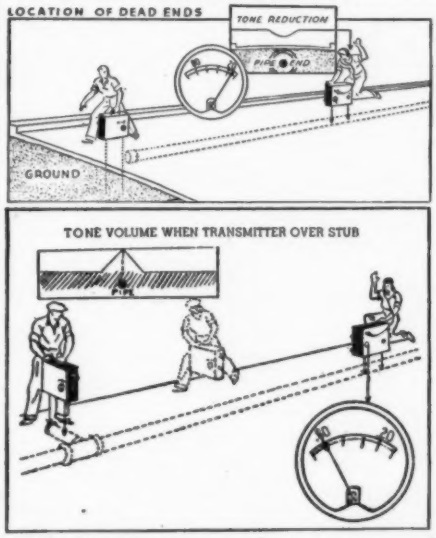


RESERVOIR REBUILT WITH "GUNITE"

Shown above are "before" and "after" pictures of a twin reservoir at Saranac Lake, New York, which we lined with reinforced "GUNITE" in 1928. The original reservoir was partially lined with rip-rap, leaked considerably, and was very difficult to clean. The "GUNITE" lining converted this structure into a modern sanitary reservoir, with no leakage, which can be cleaned quickly and easily.

Our 74-page bulletin 2200 describes many reservoir jobs and other types of "GUNITE" work. Write for your copy.

MANUFACTURERS OF THE "CEMENT GUN"



M-SCOPE
Buried Pipe Finder and Leak Detector

FREE 16 PAGE BOOKLET UPON REQUEST

The M-SCOPE consists of a specially designed radio Transmitter and Receiver, with conductive wire. In operation, the Transmitter sends out a continuous signal, and when there is no metal between Transmitter and Receiver, a definite volume of sound is heard in the Receiver earphones and the meter (mounted on Receiver) gives a definite reading. If a metal object lies between the two units, sound in earphones is louder and meter reading higher—and the pipe or other metal object is located.

The M-SCOPE is solving — successfully — the varied problems involved in the development, operation and maintenance of buried pipe and cable systems and is in daily use by representative organizations in such important groups as:

- **Government Projects**
- **Municipalities**
- **Sewerage and Water Plants**
- **Consulting Engineers**
- **Airports**
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Write for further particulars and booklet:

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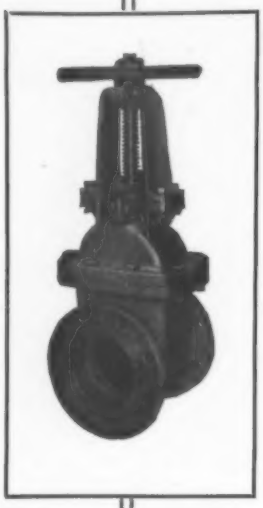


that RENSSELAER Valves are being used the world over on many of the largest floating drydocks.

Valves are playing a vital role in this "war of Engineers."

RENSSELAER is proud to be among those who serve.

•

WRITE FOR BULLETIN X

RENSSELAER VALVE COMPANY

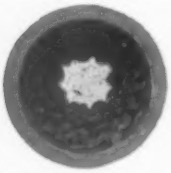
TROY, N. Y.

MORE WATER —LESS WORRY

by CLEANING your WATER MAINS using The NATIONAL METHOD

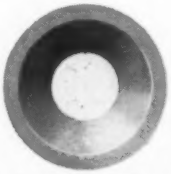
No need to worry about reduced water main capacities just when you need every gallon you can pump. Do as many other communities — large and small — are doing: clean those old clogged up mains by using the NATIONAL METHOD of water main cleaning.

We offer you (1) greater volume of water; (2) lower pumping costs; (3) improved pressure; (4) cleaner water and (5) reduced insurance rates.



Before Cleaning

★ The NATIONAL METHOD



After Cleaning

GUARANTEED TO RESTORE 95% ORIGINAL CAPACITY

The National Water Main Cleaning Co.

30 Church St. New York 7

Branches:

115 Peterboro St., Boston 15, Mass.
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205 West Wacker Dr., Chicago 6, Ill.
501 Howard St., San Francisco, Calif.
2028 Union Ave., Montreal, Can.
576 Wall St., Winnipeg, Can.

Howard Sommers Becomes Mathieson's Chief Engr.

Howard A. Sommers has been made Chief Engineer of The Mathieson Alkali Works with headquarters in New York City.

Mr. Sommers joined the Mathieson organization in 1925, several years after he was graduated from Case School of Applied Science, serving in the Niagara Falls plant, first as Mechanical Engineer, then as Assistant Plant Superintendent.

H. A. Sommers

Then followed positions as Sup't of the Dry Ice and Lime Recovery Plants at the company's Saltville, Va., division, Asst. Plant Engr. at the Niagara Falls Plant, Project Manager from the New York headquarters of the company, Manager of the Magnesium Plant at Lake Charles, La., and most recently as Project Engineer for the company.

He is a member of the American Society of Refrigerating Engineers, the Compressed Gas Manufacturers Association, and the Manufacturing Chemists Association.

Westinghouse Appointments

L. C. Blevins, Meter Div. Sales Mgr.; Buechner, Watthour Meter Sales Mgr.

The appointment of Leonard C. Blevins as sales manager of the Meter Division of the Westinghouse Electric and Manufacturing Company has been recently announced.

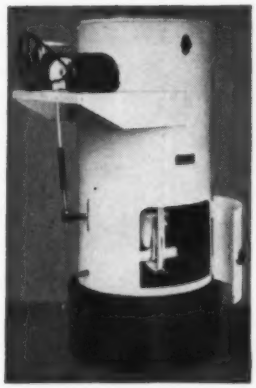
Born in Green Cove, Va., Mr. Blevins was educated at Konnarock, Va., and graduated first in his class at Emory and Henry College at Emory, Va. He joined the Meter Sales Department of Westinghouse at Newark in 1920 and became sales manager of Watthour Meters in 1937. He recently completed 25 years employment with the Westinghouse Company.

H. L. Buechner was appointed to succeed Mr. Blevins as Watthour Sales Manager. He joined Westinghouse in 1916.

SPECIFY AN

OMEGA

UNIVERSAL



These rugged, dependable volumetric feeders will feed:

Alum	Lime
Ferrisul	Soda Ash
Ferrifloc	Carbon
Ferrous Sulphate	Clay, etc.

Dissolving chambers of proper capacity are furnished for rate of feed specified.

Other OMEGA Products

Gravimetric Feeders
Solution Feeders
Lime Slaking Equipment
Mechanical Agitators
Bucket Elevators
Laboratory Stirrers

Write for descriptive bulletins

Sincerely

OMEGA MACHINE CO.
(Division of Builders Iron Foundry)

9N CODDING ST., PROVIDENCE 1, R. I.

Yeomans Strengthen Representation in Missouri and Illinois

That the Van Devanter Engineering Co. of St. Louis have become their sales representatives is announced by Yeomans Brothers Co., Chicago, manufacturer of pumps, compressors and sewage treatment equipment. The St. Louis firm will handle sales and service to municipalities in eastern Missouri and

M. S. VanDevanter

southern Illinois. This supplements Yeomans' representation in this area, since the H. L. Grossman Co., also of St. Louis, will continue in the building and industrial fields in much of the same territory.

M. S. Van Devanter, founder of the firm, is also president of Russell and Co., Inc., which specializes in erecting, maintaining and operating sewage treatment plants and other sanitary facilities for municipalities. In this connection the firm maintains well equipped laboratories for biological analysis.

Creto-Masonry Waterproofing with Liquid

According to the claims of Guaranteed Products of 1117 Crenshaw Blvd., Los Angeles, Cal., Creto is the real thing for waterproofing masonry, inside or out. One application of Creto to painted or unpainted surface of brick, stucco or concrete (even if the surface is wet) is all that is needed to stop leakage.

The news item from the company says that Creto "changes component parts of masonry into one single solid mass, preserves, stops seepage and locks in alkali and lime in event the concrete is to be painted, and paint will not crack if Creto is applied first." That sounds like some good press-agentry, but if it's true, then Creto should find a ready market in a lot of sewage pumping station dry wells, so called.

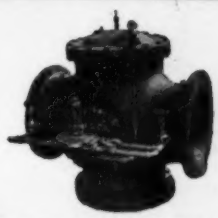
· 1879 ·

ROSS

AUTOMATIC VALVES

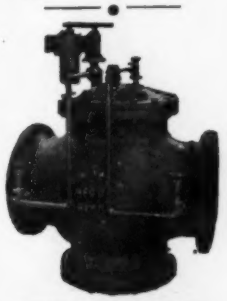
ALTITUDE VALVES • SURGE • RELIEF • BACK PRESSURE VALVES

FLOAT VALVES • REDUCING AND REGULATING VALVES



ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs, hydraulic control.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.
4. Can be equipped with electric and manual controls.

COMBINATION VALVE
This valve will permit flow in one or both directions acting as
1. Pressure Reducing and Relief Valve.
2. Pressure Reducing and Altitude Valve.
3. Relief and Altitude Valve.



REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

"Blueprint Now!"

ROSS VALVE MFG. CO.
INCORPORATED
P. O. BOX 595, TROY, N. Y.

84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 2" TO 84"

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

Pittsburgh Meter-Merco Nordstrom Strengthen Service in N. Y.-N. J. Territory

Pittsburgh Equitable Meter Co. and Merco Nordstrom Valve Co. have recently appointed two additional service engineers to the New York District Office of these companies. These men, William H. Johnson and George

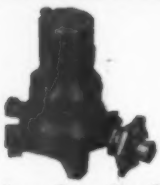
W. H. Johnson

G. L. Geuss

L. Geuss, will handle the sale and service of Pemco and Merco products in sections of the territory under the jurisdiction of M. J. Harper, District Manager. The New York office territory comprises most of New York and the entire state of New Jersey.

"Bill" Johnson, formerly with Phoenix Meter Co., has been con-

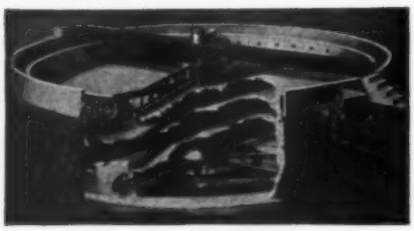
What has happened to this METER?



It has had an Expansion Connection screwed onto one spud so that . . .

. . . it can be installed water-tight in any type of Ford Yoke quickly and easily, without disturbing the piping. Hundreds of thousands of Ford Yokes are in service. Send for our catalog describing the many styles of Ford Yokes and other equipment for making better meter settings.

FORD Meter Box Co.
WABASH, INDIANA



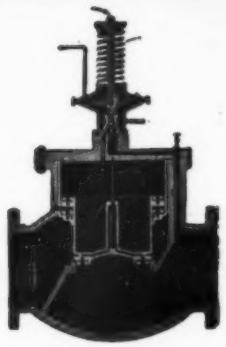
P.F.T. Clarifiers for Rapid Precipitation of Sewage Solids

The P.F.T. Tray Clarifier embodies a design which affects the continuous rapid separation of the solids and liquid in sewage; and the immediate removal of the clarified effluent. A series of shallow settling areas over which the sewage is spread assures speedy precipitation. Its high rate of flow provides maximum capacity in minimum space; reducing the construction and operating costs of clarification equipment.

Write for Bulletin No. 210 containing complete information, including operating results.

P.F.T. Pacific Flush-Tank Company
4241 Ravenswood Ave., Chicago, Ill.
New York Charlotte, N. C.

Stop Check Single Acting Altitude Valve



This valve installed in the upstream line automatically maintains a uniform water level within 3" to 12" variation to prevent any tank overflow; also, by means of the internal "stop check" piston assembly, prevents loss or return of storage water back through the valve—making the valve very desirable for use where metered water is purchased, or wherever it is imperative that there be no possible return flow.

This valve may be fitted with "Differential" Control for delayed opening, if desired.

Write for specifications and prices.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

Only "Varec" pressure relief & vacuum breaker valves give you all these Specific features!

- HYPERBOLIC STATIC-BALANCED PALLETS insure less "blow-down."
- PALLET GUIDES are not exposed to corrosive tank vapor.
- GREATER FLOW CAPACITY Expanding streamlined passageways eliminate directional changes and eddying currents.
- WIND DRIFT is eliminated by scientific design.
- NONCORROSIVE AND NONELECTROLYTIC ACTION Materials are used having best thermal, electrical potential, and noncorrosive factors in combination.
- GREATER DURABILITY Materials and design insure longer life.
- REPLACEABLE SEATS guarantee minimum maintenance expense.
- FIELD PRE-TEST All "VAREC" equipment is pre-tested to actual field installations.
- FOOL-PROOF Pallet guiding system positively prevents binding or freezing.
- NONFREEZING Drainage throughout the unit is complete—no condensate can accumulate.
- WEATHERPROOF Properly protected against all kinds of weather, mud-dobbers, birds, etc.
- TWENTY YEARS EXPERIENCE is built into every unit.

"VAREC" approved Pressure Relief and Vacuum Breaker Valve with Flame Arrester. Fully streamlined, with hyperbolic pallets, this valve operates always at its predetermined true static pressure.

• The Safe Venting of Digester and Gas Holder Domes is the job this valve performs, 24 hours a day, year in and year out. Its efficiency, performance, and economy are attested by thousands of installations throughout the country plus years of research and laboratory experiments.

Other "VAREC" Products

Flame Trap Assemblies—Pressure Relief and Vacuum Breaker Valves—Flame Arresters — Flame Checks — Regulators — Check Valves — Drip Traps — Manometers — Explosion Relief Valves — Manhole Covers — Sample Hatches.

THE VAPOR RECOVERY SYSTEMS CO.
Consultants, Designers, and Manufacturers of Gas Control and Tank Equipment
COMPTON, CALIFORNIA
Branch Offices and Stocks Carried at New York City—New Orleans, La.—Houston, Texas—Tulsa, Okla. Agencies Everywhere.

nected with the manufacture of water meters and water meter parts for the past 15 years. During this time, he gained a wealth of experience not only as a manufacturer of water meters, but from dealing directly with water meter users.

Mr. Geuss has represented Pittsburgh-National and Merco Nordstrom for several years, covering a part of New York State. In his new assignment, he will cover the same area as before, plus some new territory in New York. A native of Missouri, Mr. Geuss received much of his early training in the meter, valve and regulator business under his father.

LITERATURE AND CATALOGS

We have a friend who writes us on a typewriter but never uses any capital letters and we understand that Fred Allen does the same. Now we are very fond of both but abhor this habit. Naturally, when we see the letters **a. c. f.** in advertising we think of our friend and Fred Allen, when we should really think of **a.c.f. Full Pipe Area Lubricated Plug Valves,** which are described in Bull. CC-5M-145 of that name, issued by the American Car and Foundry Co., Valve Dept., 30 Church St., New York, N. Y. These plug valves have been advantageously used on air lines to diffusers, suction and discharge of sludge pumps, sludge and supernatant lines on digestion tanks, sludge sampling cocks, gas valves, etc. If you want more information on individual valves than is given in the bulletin, write for Catalog 3-C.

You won't find it difficult to read a bulletin just issued by Marlow Pumps of Ridgewood, N. J. Entitled **"Self-Priming Centrifugal Pumps,"** it is a definitive work on one of the most important pump developments of recent times. Written in easy-to-understand "first reader" style, the booklet sets forth the principles of centrifugal action, the physics of pumping and the evolution of self-priming centrifugal pumps.

In addition to basic engineering information, the bulletin tells the difference between the types of self-

EDDY
FIRE HYDRANTS AND VALVES—
WATER WORKS EQUIPMENT

EDDY VALVES
For
Water Works
and
Sewage Disposal
Plants

EDDY FIRE HYDRANTS
For Fire Protection Service

Write for Complete Catalog

Eddy
VALVE COMPANY
WATERFORD, N. Y.

MEMO TO: ENGINEERING DEPT.
Chemco Chlorinators must be better— because nearly 700 machines are now in service. Chemco equipment has been specified by engineers since 1925. Send for the following free bulletins:
Bulletin 300-1-Type M-1
Bulletin 300-3-Type M-3
Bulletin 300-5-Type M-5
J R M.
CHEMCO TYPE M-1
CHEMCO TYPE M-3
CHEMCO TYPE M-5
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COMPLETE PURIFICATION SYSTEMS
FOR SWIMMING POOLS
ETC.
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MID-WEST FACTORY BRANCH
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REPRESENTATIVES IN PRINCIPAL CITIES

priming centrifugals, points out where self-primers can be used with best effect, and details how to install and care for them.

Authored by A. S. Marlow, Jr., before he entered the U. S. Navy, this treatise sums up the results of nearly fifteen years of work with self-priming centrifugals. According to the news release on this bulletin, Marlow engineers have been called the originators of the modern self-priming centrifugal. Copies of the handbook may be had without cost by writing to Marlow Pumps, Ridgewood, N. J.

":x?&#-*$" is the heading of the editorial in the Feb. issue of **Clay Pipe News,** published by the Clay Products Association of 111 W. Washington St., Chicago 2, Ill. This "cartoon talk," as the editorial says, is not only highly expressive but is universally understood, and the editorial continues, "this talk is what most mayors, councilmen, taxpayers, and engineers say when they find that the local sewer lines have disintegrated and need replacement."

Naturally one may expect the editorial to lead into an argument for clay pipe and to ask for stories on interesting uses of the same. In this issue there is a story of Magna, Utah, "the town that dug into its pockets to pay for its sewers." In addition there is also a picture of a pretty girl, and a cartoon of considerable interest to the devotees of *Esquire,* as well as some tables of ASTM specifications for clay pipe.

Centrifugal pumps are O. K. for sewage pumping when the flow is fairly large, but can you imagine a centrifugal pump pumping less than 30 gpm. of sewage and not getting plugged up? No, you can't imagine it, can you? But a Yeomans Expelsor will do the job. That is the theme of **Bulletin 4402—Expelsor Sewage Ejector,** recently issued by Yeomans Bros. Co. of Chicago.

The bulletin has drawing, illustrations, and design data on the Expelsor which operates on either compressed air or steam. Requiring no screens, no shredders, no packing, no wet well, no shafting, and no bearings, the ejector will pass solids up to the size of the inlet and discharge valve (4 in. minimum). The compressor is outside of the well and operates if a.c. powered, when the level of the sewage in the Expelsor tank rises to the level of one electrode and shuts off when the level drops to the bottom of

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another electrode at the bottom of the tank. When powered by D.C. motors, the system operates on a float. From the list of Expelsor installations given in the bulletin, it looks as though the idea is as good as it sounds.

We are not Hoosiers by birth but we were raised within a few miles of the Banks of the Wabash. Near enough at least to have an interest in the Hoosiers and their problems, particularly when those problems relate to sewage or industrial waste.

All of which is to say that we were particularly interested in the Dec. 1944 issue of **Sewage Gas,** a Publication for Sewage Treatment Plant Operators, issued by the Division of Environmental Sanitation of the Indiana State Board of Health.

This particular issue is devoted to industrial waste problems, with a short article on each of several sewage plants in Indiana and the particular headaches that bother the various superintendents concerned.

For example, Dave Backmeyer at Marion says that 5000 gal. of spoiled milk dumped by a dairy in the early dawn didn't help his activated sludge plant one bit. Neither did fuel oil from overflowing storage tanks. Here in the east we are slowly freezing for lack of sufficient fuel oil and out there some "dope" lets the tanks overflow. Although Dave says that they skim it off the tanks, he didn't seem overjoyed at this method of getting the oil. He'd rather spend ration coupons for it.

We've mentioned before, elsewhere in this magazine, about the sodium cyanide episode in the White River at Anderson, where R. R. Baxter had this problem to contend with one morning last November. Yes, 4.0 ppm. of sodium cyanide deserved an investigation, which Baxter reports was successful in stopping the loss.

John Hupp at La Porte says that long woolen underwear may have its place, but that place is not in a sewage plant, particularly when it is the wool fibers that do not get in the underwear but do get to the plant. Grease from the wool washing is no help either for easing the operation of the sludge lines and digesters.

Irel V. Pence at Peru has canning waste problems, Paul W. White at Muncie has pickling liquor waste as well as canning wastes, and Paul L. Brunner at Ft. Wayne has chicken feathers and chromic acid. The chicken feathers aid remarkably well in plugging up the sludge lines, especially when mixed with grease. Chromium in the amount of 3,600 ppm., accompanied by a pH of 2.3, is also on the unwanted list in Ft. Wayne.

W. E. Ross at Richmond and D. O. Bender at Indianapolis are confronted with packing house and plating wastes, among others. After reading this issue of the **Sewage Gas,** we can only repeat what we said in Canada last November, to wit, "Industrial waste disposal is the problem of today; its solution is the program of tomorrow."

Here's another bulletin for you who are interested in protection against corrosion by protective coatings. A 4-page technical folder on **Amercoat No. 44 Plastic Coating,** the outstanding property of which is acid resistance, is now available from the Amercoat Division, American Pipe and Construction Co., P. O. Box 3428, Terminal Annex, Los Angeles 54, Cal.

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A. O. Witt, Editor of **Bores and Strokes**, published by Schramm, Inc., manages to put something of interest to us in almost every issue of the four-page periodical. The last one shows a picture of a pipe line crossing mountainous country and a Schramm portable compressor helping. Another picture shows backfilling and five pneumatic tampers at work from one Schramm compressor. Yes, air compressors have a use in the water and sewage business. We hope that some day Mr. Witt prints a picture of an air compressor running one of Harry Fuller's "Mud-Hogs" (see *Water Works and Sewerage*, July, 1944).

Ingersoll-Rand announces the publication of a pocket-size folder entitled **Air-Operated Tools for Maintenance, Construction, Demolition.** This bulletin shows at a glance the line of I-R air tools and portable compressors available for speeding up work. Necessarily brief, only representative models are pictured, although ample information is given as to size ranges and model variations.

Photographs illustrate air tools on construction, demolition and plant maintenance jobs, as well as new uses for well-known tools and various accessories to air-tool operation.

Write Ingersoll-Rand at 11 Broadway, New York 4, N. Y., or any branch or dealer for a copy of Form 117.

Many is the time when we have softly sworn at the lipstick on the drinking water glasses in some eatery. Lipstick is delightful—on the lips—but on glasses it only serves to remind one that the dishes and eating utensils are not clean. We wish that all restaurant owners could see the Feb. issue of **Silicate P's and Q's**, in which it tells of the use of sodium metasilicate (sold as Metso Granular) for this purpose.

And if you want to polish silver, just place it in a tin plated pan and add a 1 per cent solution of sodium metasilicate at a temperature of 160 deg. F. Silicates also inhibit the corrosive action of mild alkalies on aluminum. Of course, you don't have much aluminum wear or silver in your water or sewage plant but you might find Metso helpful in washing laboratory dishes, particularly the grease coated sample bottles in a sewage plant. Your wife might also like to know about the stuff.

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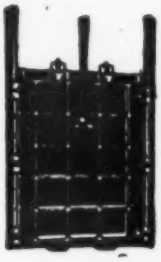

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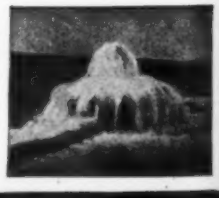

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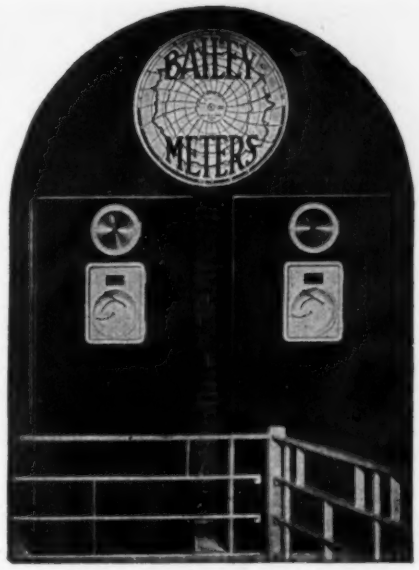
There aren't many laboratories being built at the moment, but the post-war plans of a number of cities throughout the country call for water and sewage plant laboratories, and when built they will need sinks. The designers who are drawing these plans may be interested in Bulletin No. 405, **Storage and Mixing Equipment for Acid and Corrosive Materials,** as issued by U. S. Stoneware, Akron, Ohio.

Most of our friends think of activated sludge where anyone mentions air diffusion, but when The W. B. Connor Engr. Corp. issued a catalog on **Kno-Draft Adjustable Air Diffusers** they were talking about ventilating and air recirculation in industrial plants. This new catalog simplifies the selection and application of Kno-Draft air diffusers and is more of an engineering handbook, filled with sketches, charts, instructive text and dimension prints that provide the engineering data necessary for the proper application and performance of air diffusers and ventilation in general. Separate sections are devoted to accessory equipment such as dampers, air equalizing grids, mounting rings and air sectorizing baffles. The catalog, a durable loose-leaf binder to facilitate the insertion of supplementary or revised data as issued, may be obtained from Dept. D, W. B. Connor Engineering Corp., 116 East 32nd Street, New York 16, N. Y.

You probably know all about the products of the Norwood Filtration Co. of Florence, Mass., but when we recently looked over a set of bulletins from the company we found that we had "sort of" forgotten some of them. Perhaps you too have forgotten that besides pressure filters, Minchar activated carbon, and the Hartman Ozone Water Sterilizers, Norwood makes the new **Hartman Multiple Paper Disc Filter** with the triple-disc filter pads for filtering water and the Hartman Air Reconditioning and Deodorizing Unit. The company will welcome inquiry for bulletins on any of these products.



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The first annual edition will be released in January 1945. It will be comparable to the English edition of the Reference and Data issue of Water Works and Sewerage, which is used by superintendents, operators, engineers and public officials throughout the United States and many other countries.

The Managing Editor of Ingenieria Sanitaria spent the summer of 1944 in South America making studies and reports of this field.

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Operator Licensing in Indiana

Last Spring we attended the meeting of the Indiana Section of AWWA and heard a paper and considerable comment on the licensing of water works operators. Seems as though the state legislature had turned it down. Undaunted the boys in Indiana are trying again and the Feb. issue of *The Waterspout*, of the Indiana Section is devoted entirely to that subject.

Beginning with an editorial (that has all the ear marks of the fine hand of Joe Quinn) requesting support of the operators by writing their legislatures, the issue contains a copy of the bill now in the legislature, resolutions of the Indiana Sec., the Indiana Sew. Wks. Assn., and the Stream Pollution Control Board of Indiana, together with "the voice of the Indiana Water Works Superintendents," and an opinion from AWWA Secy. Jordan. There are letters from N. Y., Conn., N. J., W. Va., Tex., Mich., and Fla. explaining how licensing works in those states.

Also in the same issue is a summary of the results of a questionnaire on the subject of licensing and short schools to be held at Purdue. Those who have replied to date show a vote for licensing of water works operators of 4 to 1, and of sewage operators of better than 3 to 1.

The vote was less than 3 to 1 for a water works school, and less than 1½ to 1 for a sewage short school. If schools are held the boys want a certificate and for the most part they think one week's study is enough.

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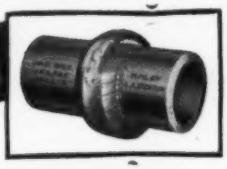

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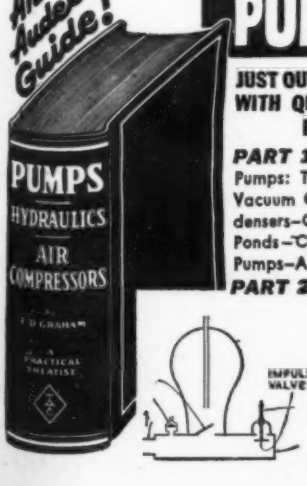

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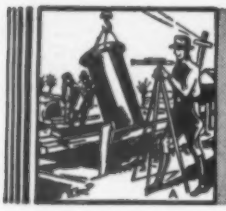

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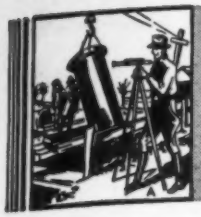

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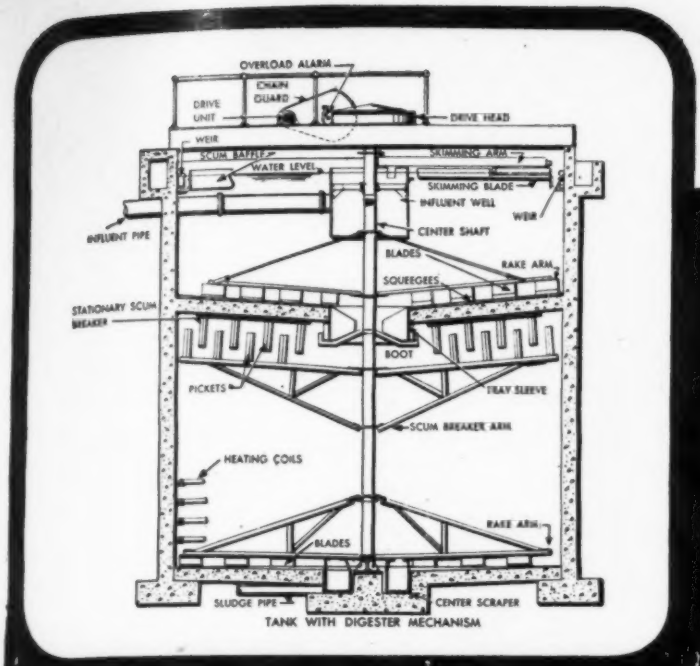

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